SCIENTIFIC AMERICAN

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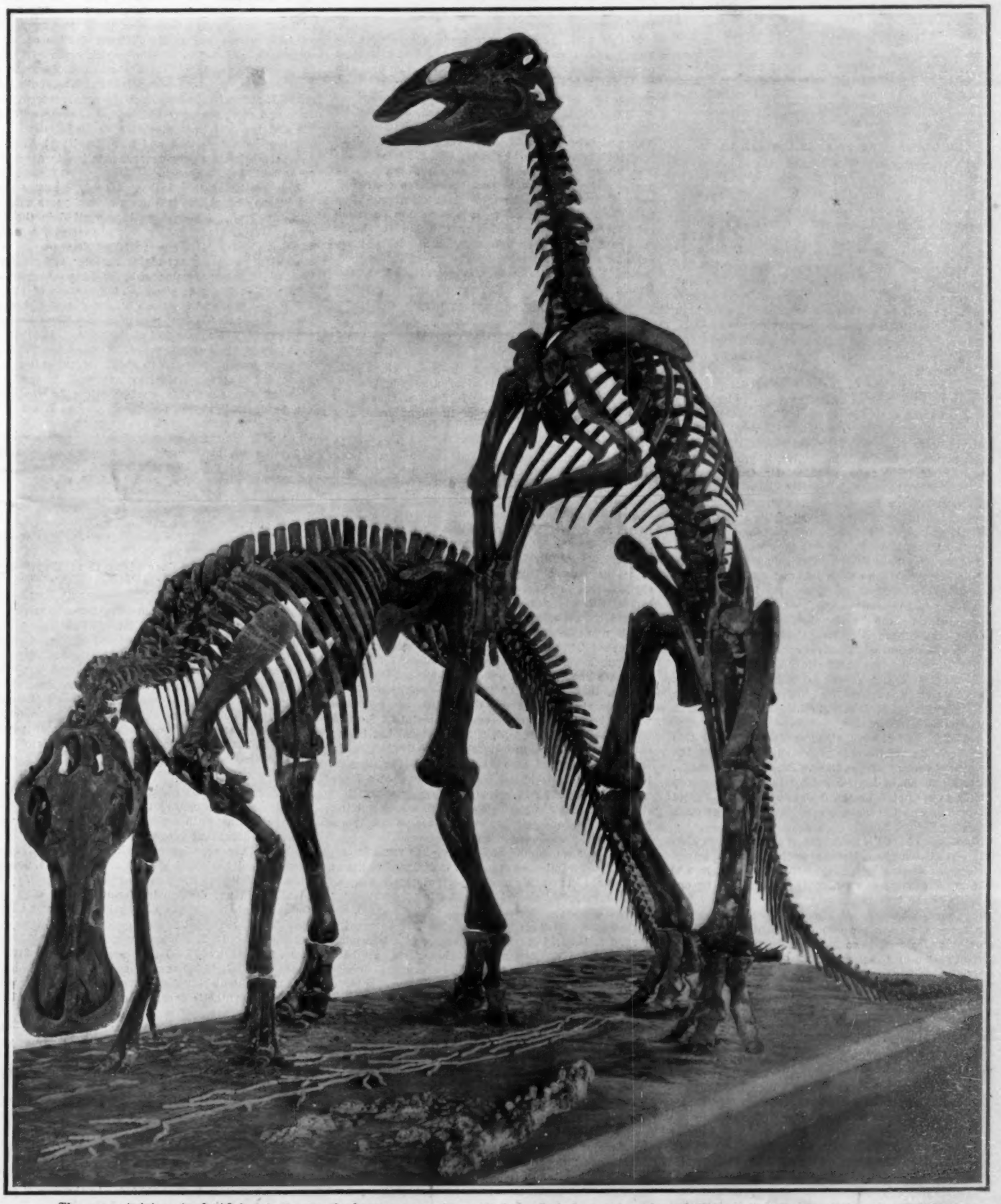

The erect skeleton stands 17 feet high. On the base, representing a ripple-marked shore, are rushes, shells, and fossil leaves of the same period.

THE TRACHODON GROUP IN THE AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK.—[See page 65.]

SCIENTIFIC AMERICAN
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NEW YORK, SATURDAY, JULY 23rd, 1910.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE RESIGNATION OF REAR-ADMIRAL CAPPS.

THE resignation of Rear-Admiral Capps as Chief of the Bureau of Construction and Repair has a double significance. Not only does the United States Navy lose from this important bureau the services of one of the most able and high-minded officers that ever held the position of Chief; but his retirement marks the successful termination of a newspaper campaign of belittlement and misrepresentation, carried on at the instigation of a certain clique of seagoing officers against the naval constructors, which is strangely at variance with the usually high code of professional ethics of the service.

The attempt to discredit the construction corps and rob them of their proper standing and authority began some three years ago, when an effort was made to injure the reputation of the Bureau of Construction by belittling its work as represented by our battleship fleet. In their eagerness to deal a blow at the staff the line did not hesitate to strike at the prestige of the United States Navy itself by describing the various ships as poorly designed, ineffective, ill-protected, and badly armed. The animus against Mr. Capps was intensified when he went before the House Naval Committee, and by an incontrovertible array of facts and figures, absolutely refuted the allegations of the line officers, and proved not only that our ships were the equal, but that in many respects they were the superior of contemporary ships in foreign navies.

The dignity of the course followed by Mr. Capps is shown by the fact that, in spite of the free use which was being made of the press in this attack, he never condescended to use the same medium for reply. Not even in the case of the SCIENTIFIC AMERICAN, which had espoused the cause of the naval constructors solely on the merits of the case, did he furnish or even suggest the facts upon which our refutation of the attack upon his work was made. We could wish that the same strict attention to professional ethics had been observed by the officers of the line.

No one, we feel assured, more deeply regrets this deplorable lack of the true professional spirit than the present Secretary of the Navy. Proof of this, surely, is to be found in his assurances that his strenuous policy is prompted by the desire to raise the United States Navy to the highest possible standard of efficiency.

Questions of good taste, however, do not come within the jurisdiction of the Secretary—they must be settled among the officers themselves. But when it comes to the use of the press as a medium of attack by one section of the service upon another, there is involved the direct violation of a rule which was drawn up for the express purpose of preventing this very abuse; and we have good reason to believe that an investigation by the Secretary of this phase of a very regrettable controversy would not have to proceed very far before the principal offenders were disclosed.

We hold no brief for the Corps of Naval Constructors; but we do for the fair name and dignity of the United States Navy as a whole.

A SUGGESTION FOR THE FULTON MEMORIAL.

IT is altogether fitting that the permanent memorial to the great work of Robert Fulton in inaugurating steamboat travel on the Hudson River, should be erected on a scale of magnificence commensurate with the importance of his work. The design by H. Van Buren Magonigle for a monumental water gate to be built on the bank of the Hudson at Riverside Drive, New York city, to which the Fulton Memorial Association lately awarded first prize, will at once constitute a worthy landing place for distinguished guests of the nation, and, as a lasting tribute to Fulton and his work, will be a monument of which the city, the State, and the nation may be justly proud.

There is one regard, however, in which the significance of this memorial could be greatly and very properly extended; and if the change herewith advocated were made, we believe that not only would the success of the Memorial Association in raising the three million dollars needed for construction be more certainly assured, but the memorial itself would assume a dignity and secure a world-wide interest which otherwise it could never attain.

We refer in this connection to the proposal which has been made to constitute the gateway a memorial not merely to Robert Fulton and his work, but to all of that long line of illustrious and indomitable inventors, whose work in the development of steamboat navigation not only antedated that of Robert Fulton, but rivaled it in the production of steamboats which navigated with more or less success long before the "Clermont" took the water.

If this noble gateway were made a memorial not merely to Robert Fulton, who was the first to achieve commercial success, but to the many pioneers who made valuable contributions to the art of steam navigation, not only would the demands of historical accuracy and justice be met and satisfied, but, as all of us who have closely studied the life of Fulton are well aware, the change would be thoroughly in accord with the spirit and temper of Robert Fulton himself, who was always generous in his acknowledgment, both verbal and written, of his indebtedness to earlier inventors. If the statue, bust, or tablet to Robert Fulton be given the place of honor upon or within the memorial, it would rather enrich than bedim the honor thus paid to him, if he were surrounded with statuary or tablets commemorating the names of Fitch, Symington, Stevens, De Jouffroy, Desblancs, Morey, and Evans.

FLIGHT OF PROJECTILES.

WE direct attention to the letter of Prof. Alger, of the Naval Academy, Annapolis, on another page, in which he gives a lucid description of the theory which holds that an axis of a projectile is so acted upon by gravity, air resistance, and gyroscopic tendencies, that it remains throughout the whole of its flight practically tangential to the trajectory. The theory which he presents is the theory of the schools, and it cannot be denied that the results of the experimental firing through screens afford strong presumptive evidence that the shell is traveling head-on and with its axis tangential to the curve of flight.

At the same time, it must be remembered that artillerists are divided in their opinions upon this subject, many of them holding the view which we presented in our issue of July 2nd, and basing their conviction, as we have done, largely upon the fact that 12-inch shells during the Russo-Japanese war did strike heavy armor with energies which theoretically should have effected complete, or at least partial penetration, and which nevertheless failed to make any penetration whatever. Of course, it would be manifestly unfair to presume that this failure proves our case; for it may well have happened, and unquestionably did frequently happen, that, because of the worn condition of the Japanese rifling, the speed of rotation of the shells was far below what was necessary to maintain them in true end-on flight. Indeed, it is notorious that in the battle of Tsushima Straits, this actually happened; and Capt. Seminoff, who was on one of the Russian battleships as a technical observer, says that a large number of Japanese 12-inch shells, as they approached the Russian ships, were distinctly seen to be tumbling end over end, and were facetiously nicknamed "portmanteaus" by the Russian officers.

The Ordnance Bureau of our navy has recently carried out some full-sized experiments designed to get at the actual facts on this most important question. Using the old ram "Katahdin" as a floating battery, they erected armor plates upon it, and attacked them, not with reduced charges at short ranges (the proving ground method), but with full charges at actual fighting ranges. We understand that these tests have been completed and have furnished the Bureau of Ordnance with the desired information, which, however, is being kept secret, and very properly so.

BRILLIANT AEROPLANE PERFORMANCES AT RHEIMS.

IF the annual meet at Rheims is to be the accepted gage by which to measure the yearly advance of the aeroplane, the past year must ever be considered as one of the most brilliant in the history of air navigation. As the meet of 1909 demonstrated that the aeroplane was a practical machine capable of perfect control and full of promise for the future, so the meet of 1910 has shown that these expectations were well founded, and that the aeroplane has inherent possibilities of speed and endurance, the limits of which it would take a bold prophet to foretell. And while French aviators were making demonstrations of speed and endurance, a Wright machine, the parent type of all heavier-than-air flyers, was placing a new world's record for height, by soaring to elevations of over one mile above the earth. At the present writing, the record for height, made by Brookins at Atlantic City, stands at 6,175 feet; the record for speed, made by Morane at Rheims, is 66.53 miles an hour; and the record for distance and duration, established at the same place by Olieslagers, is 244.20 miles in 5 hours, 3 minutes, and 5 seconds.

Outside of the records themselves, the most important fact established by the Rheims meet was the unquestionable superiority of the monoplane, which not only made all the records, but also captured most of the prizes. Its success must be particularly gratifying to the French people, who from the very first have devoted special attention to the development of this type. They seem to have realized that if its inherent fragility, as compared with the strong bridge-like form of the biplane, could be overcome, there were many advantages in the way of simplicity, reduction of head resistance, and small weight, which were strongly in favor of the plane with a single set of surfaces. Furthermore, the monoplane is attractive, both because it approximates so closely in appearance to the form and structure of the birds, and because its simple and graceful lines give it a decided artistic advantage over the stiffer and more box-like biplane—this last being a strong recommendation to a people so æsthetic as the French.

It is gratifying to note how strongly the laws and conditions of flight, as laid down several years ago by our own Prof. Langley, have been verified in the recent achievements. Langley showed that as the speed increases, there is a corresponding decrease in the amount of necessary sustaining surface; and we find that while the moderate-speed Wright machine used by Brookins has a total sustaining surface of about 500 square feet, and is driven by a motor of 35 horse-power, the racing Blériot monoplane used by Olieslagers had only 129 square feet of surface and was driven by a motor of 100 horse-power. Already the Frenchmen are looking forward to speeds of 100 miles per hour; and if some satisfactory means of "reefing," or reducing the sustaining surface while in the air, can be devised, we see no reason why such a speed should not be realized within the coming year. A machine with the small amount of surface necessary for 100 miles an hour would not have sufficient area, probably, to lift it from the ground at the reduced speed while running over the ground. It should not be a task beyond the skill of modern mechanics to construct an articulated plane, whose parts could be moved within or under one another during flight, the sustaining area being reduced proportionately to the increasing speed.

Meanwhile, nothing daunted by these French successes, the three leading aviators in this country, Wright, Curtiss, and Hamilton, are building racing biplanes of small surface and large horse-power, with which they hope to retain the international cup, which was captured in such unexpected and brilliant fashion by Curtiss at last year's meet at Rheims. Curtiss, with a 50-horse-power biplane, was a match last year for Blériot with an 80 horse-power monoplane. This year he will have to face a 100-horse-power Blériot, and it is a subject for interesting speculation as to what combination of wing surface and engine power he will select for his second meeting with his old opponent.

German chemical industries have undergone a prodigious and unforeseen development since the middle of the nineteenth century. Before that date Germany was dependent upon other countries, chiefly England, for her supplies of such important chemical agents as sulphuric and hydrochloric acid, soda, potash, chloride of lime, etc. The manufacture of acids and alkalies did not develop in Germany until after the formation of the German Zollverein, or customs union, in 1833. The annual production of soda in Germany, which was only 52,000 tons as recently as 1873, had risen in 1883 to 115,000 tons, and in 1893 to 210,000 tons. In 1908, 62,000 tons of soda were exported. A still more astonishing development is that of the manufacture of synthetic dyes, or coal-tar colors. In 1897, after twenty years of endeavor, the synthesis of one of the most important of natural dyes—indigo—was placed on a commercial basis. Now Germany exports indigo and other synthetic dyes to all parts of the world to an annual value of $50,000,000, and produces three-fourths of all the artificial dyes made in the entire world. Artificial perfumes and pharmaceutical preparations in general are also made in Germany in vast quantities. In 1880 the value of the annual imports of chemical manufactures was about $25,000,000, and that of the exports about $50,000,000. In 1905 the value of the imports was $35,000,000, while that of the exports had risen to $118,000,000. As the annual value of the chemical manufactures of the German Empire is about $350,000,000, it appears that about one-third of the entire product is exported.

ENGINEERING.

Four and one-half miles of the channel at the Pacific entrance to the Panama Canal has been completed. This section extends from the deep sea in Panama Bay to within about half a mile of the end of the Panama Railroad wharf at Balboa, and throughout the whole of it the dredging has now been carried down to an average depth of 45 feet.

The proposed dimensions of the big ship which is being built for the Hamburg American Company have more than once been enlarged, until it is now finally settled that she will be 879.3 feet long over all, 95.2 feet broad, and 64 feet deep. The Shipping World, of England, states that she is to be propelled exclusively by turbines at a speed of 22 knots. These dimensions slightly exceed those of the White Star liners "Olympic" and "Titanic."

Mr. Nat Herreshoff, that prince of American yacht designers, does certainly seem to be unbeatable. The large schooner "Westward," which was built this year for an American owner, has been sailing in German waters against the new and powerful German schooners, in all events of importance that have been held this season. At the present writing, under the skillful handling of Capt. Charlie Barr, she has won every race.

The German navy has reason to be proud of its new armored cruiser of the "Invincible" type, the "Von der Tann," which is driven by Parsons turbines of 70,000 shaft horse-power. On the builders' trials, under 65,000 shaft horse-power the mean speed slightly exceeded 27 knots; and at a subsequent government trial in deep water, she made 27.5 knots. The armament consists of eight 11-inch guns and ten 5.9-inch. She can fire six guns ahead and astern, and eight on the broadside. The bunker capacity is 2,800 tons.

A correspondent in California informs us that the wonderful Lakeview gusher, which was illustrated in our issue of May 21st, had produced in eighty-six days of continuous flowing about 4,000,000 barrels of oil. The massive crib, which was drawn over the well in an effort to control the flow, has been torn asunder. An attempt was being made to build a wall of sand-filled sacks around the well and form an artificial lake, thereby damping the rush of oil. At that time the pool of oil was 75 feet across and 30 feet above the top of the well. The money value of the yield to date is over $2,500,000.

According to dispatches from London, Chili has commissioned Armstrong, Whitworth & Co. to build for them a vessel of 32,000 tons, which is to be armed with the heaviest gun in existence. The cost is stated to be $15,000,000. It is said that the gun will fire shells as heavy as those of the 110-ton gun of thirty years ago; but probably this is an error, and it should read that the penetration and energy will be as great. If Chili has actually ordered such a vessel, this is certainly a case of putting all of the eggs in one basket, for at least two serviceable dreadnoughts could be built for the same money.

We await with interest fuller details of the success of a French aviator in rising into the air from the water. The ability to do this by any type of machine, monoplane or biplane, large or small, would mark one of the most important advances in aviation. As matters now stand, the problem of alighting on land appears to have been fairly well solved by the aviator flying at such a height that he can choose an open landing place; and now that alighting and starting from the water seem to have been accomplished, the aeroplane has taken a long step forward in respect of range and safety.

The report of the Interstate Commerce Commission on the revenues and expenses of steam roads of the United States for 1910 gives the total number of miles operated as 235,925, including 1,729 miles that are not situated within the United States. The freight revenue of these roads amounted, in round numbers, to $171,000,000; the passenger revenue was $48,000,000; other transportation revenue, $16,000,000, and non-transportation revenue, $2,500,000, making a total operating revenue of $237,500,000. The total operating expenses were $159,500,000, leaving a net operating revenue of about $78,000,000, an increase of net operating revenue over the year 1909 of about $9,000,000.

Mr. Parsons states that steam turbines should not be applied to vessels of lower speed than 18 knots, and the experience of the Southern Pacific with the "Creole," running between New York and New Orleans, bears this out. Originally fitted with turbines designed to drive her at 16 knots, the vessel was found to be extravagant on fuel. She was recently taken to Cramps' yard, and fitted with reciprocating engines, which, with the original boiler plant, drove the ship at 16.55 knots from port to port, the boilers steaming easily. Much interest attaches to the 16-knot government collier, which will use turbines, with the Melvin and MacAlpine reduction gear interposed between the turbines and the propeller.

ELECTRICITY.

Now that the Sultan, who always persisted in confusing the word "dynamo" with "dynamite," no longer stands in the way, Constantinople is to be provided with an extensive trolley system. Bids for the construction of this system have been invited by Consul-General Reouf Bey.

Some time ago we called attention to the fact that the Southern Railway Company was experimenting with a gas electric car between Manassas and Strasburg, Virginia. Recently it has been decided to use cars of this type in the Greenville territory, to supplement the regular steam passenger service. Three gas-electric cars have been ordered, and while these are being built the car with which experiments were made last year will be loaned for immediate service.

Our Consul-General at Moscow reports that there is a great deal of activity in Russia in the development of electric lighting and traction systems. A long list of towns are enumerated where such systems have either been begun or about to be begun. The telephone system of St. Petersburg now includes 34,000 subscribers. Steps are now being taken to enlarge the system to a capacity of 45,000 subscribers. The city of Moscow is endeavoring to raise $5,000,000 for the purpose of extending its electric car lines.

The town of Windsor, Ontario, has decided to purchase electric power from Niagara. The 110,000-volt line to London, Ontario, will be extended over the 108 miles separating Windsor from this city. The expense of building the line to the city limits will be paid for by the Canadian government. Windsor, which is a small town, cannot use more than 2,000 horse-power, but it has contracted to sell a large share to the city of Detroit, which is directly across the river. The power used in Detroit will thus be conducted over a distance of 220 miles from the point where it is generated.

Considerable damage has been done by trawlers off the Irish coast to the cables of the Commercial Cable Company. It is stated that financial loss due to interruptions and delays caused by damage to the cables from this cause has reached a very high figure, and that this is one of the reasons why this cable company is now contemplating the laying of still another cable between this country and England. The cables are laid far enough apart to prevent damage to all of them at the same time. Hence the chances of interruption will be materially decreased by the addition of a new cable.

In one of the papers read at the Jefferson convention of the American Institute of Electrical Engineers, attention was called to the fact that the consumption of energy could be materially reduced by equipping cars with ball bearings. The importance of letting a car coast as much as possible without disturbing the schedule is coming to be appreciated. On some of the roads clocks are provided which register the time during which a car is coasting, thus keeping a check on the motorman and insuring a more economical operation of the road. By using ball bearing on the street cars the coasting periods could be materially extended, thus effecting a further saving of energy. Furthermore, the passengers would find their ride more comfortable and the maintenance charges on brakes and motors would be reduced.

If a person is not killed by an electric shock, he will receive no permanent injuries from his experience, as there are no after effects. This statement is made on the authority of Dr. J. E. McGowan, who is the surgeon of the Commonwealth Edison Company and the Chicago Telephone Company. Dr. McGowan recommends that any of the following solutions be applied to burns produced by the electrical discharge: Oil, solution of soda, boracic acid, a mixture of linseed oil and lime-water. It is seldom that a man is killed by less than 500 volts, though Dr. McGowan did come across a case in which 360 volts was sufficient to kill a man. Low-voltage shocks are usually accompanied by hysteria and a nervous condition, which however is not permanent, as unscrupulous lawyers would have one believe.

The freight trains of the Lehigh Valley Railroad are soon to be equipped with portable telephone outfits. In case of a breakdown between stations, it is often difficult to communicate with the dispatcher, and many delays are due to this cause. It is expected that the telephones will do away with such delays, as they may be connected with telephone wires at any point along the track by means of an extension pole which is hooked over the line. The telephones will also be used on the passenger trains, to permit passengers to communicate with their friends while a train stops at a station. Furthermore, it will be possible to reach a passenger, by phone, provided one is aware of the train on which he is traveling, by calling up the next station ahead and having a page call the passenger to the train telephone as soon as the train enters the station.

SCIENCE.

According to newspaper dispatches, the Radium Institute of London finds it hard to obtain the 5¼ grammes of radium needed to equip the Institute properly for its therapeutic work. The firm which undertook to supply that amount is unable to live up to the contract. The Institute is to be opened in October.

The highest kite flight on record was made at the Mount Weather Observatory of the United States Weather Bureau May 5th, 1910, when altitude of 7,262 meters (23,826 feet) above sea level was attained. The highest previous flight was made at the same observatory October 3rd, 1907, when an altitude of 7,044 meters was reached. The altitude of the observatory is 526 meters (1,722 feet).

The first woman who ever became a fully qualified medical practitioner was Dr. Elizabeth Blackwell, who died recently in England, although she was an American by birth. She studied medicine at the University of Geneva, New York. She went to London in 1849 and although finding much opposition, entered St. Bartholomew's Hospital as a student. In Paris she contracted opthalmia from a patient, with the result that she lost an eye. Then her hopes were blasted of making surgery a specialty. In 1851 she returned to America and established a dispensary, which afterwards grew into the New York Infirmary for Women.

The report of the British Association meeting at Winnipeg in 1909, just published, contains the full text of the report by Gold and Harwood on "The Present State of our Knowledge of the Upper Atmosphere as Obtained by the Use of Kites, Balloons and Pilot Balloons." This important digest of all that is now known in the field of aerology was heretofore available only to the few institutions and individuals who received copies of the preprint distributed at the time of the meeting, and is now commended to the attention of every one who is interested in the newest and most fascinating department of meteorology.

M. Henri Coupin finds that if any moist organic body be dropped to the bottom of a flask full of oil, after a few days we can observe the formation on this body of an envelope consisting of various species of mold, principally Penicillium glaucum. As has been shown by Mr. van Tieghem, this mold has the curious property of becoming covered, within the oil, with sporiferous apparatus forming together a clearly visible green layer, which is a remarkable phenomenon when we consider that this Penicillium always remains sterile when submerged in water. The author has studied the vegetation of such mold in sterilized mediums, and indicates the results of his observations.

According to a communication made to the French Academy of Sciences by M. Marage, the power of a voice being in direct ratio to the product of the volume *V* of air escaping from the lungs, multiplied by its pressure *H*, an orator or singer will endeavor to improve one or both of these factors. In a note presented to the Academy November 11th, 1907, the author showed how *V* could be increased by three breathing exercises, and in a second note dated June 15th, 1908, he reported on the results obtained with some public school pupils. In his new communication he shows how the factor *H* may be increased by strengthening the muscles of the abdominal wall, and by causing the vocal cords to unite along a median line through the medium of exercises with the vowel sounds *A* and *E*.

The German Aero Club had planned to release a large number of unmanned balloons at the time of the expected passage of the earth through the tail of Halley's comet, in order to determine the amount of dust contained in the atmosphere, and any admixtures of foreign gases. The well-known Aitken dust-counter was to be used for ascertaining the dust contents. For determining the presence of foreign gases, the Lindenberg observatory provided evacuated glass bulbs. These bulbs have a pipe which is broken off at predetermined altitudes so that air from that height may enter the bulb. A wire heated by a storage battery then melts and closes the pipe at the same height. The samples thus taken can be examined carefully at some later time. The results are not available as yet.

In a communication to the French Academy of Sciences Carl Störmer describes a remarkable series of photographs of the aurora borealis made by him at Bosekop, Norway, in February and March of this year. By the use of a cinematographic lens of 25 millimeters diameter and a focal distance of 50 millimeters, and Lumière plates, he was able to make pictures with an exposure ranging from a fraction of a second to 20 seconds. Of 800 photographs taken about half were successful. Having solved the problem of making satisfactory pictures he applied the photographic method to the measurement of the aurora and the determination of its position in space. Simultaneous photographs were taken from two stations about 4 kilometers apart, connected by telephone. Comparing the position of the aurora among the stars on the two plates, it was possible to calculate its altitude and distance with great precision.

AUTOGRAPH OF A THUNDERBOLT.

BY PROF. R. W. WOOD.

On the afternoon of June 23rd a flash of lightning struck on the lawn behind our summer home at East Hampton, Long Island, not fifty feet from the house and some tall trees which overshadow it. I was about to cross the lawn at the time, but had been detained for a few seconds to reply to a question, and was looking in the direction of the flash when it came.

There was a blaze of light at the surface of the ground where the bolt struck, and a column of smoke or steam seven or eight feet high. The report was not deafening, resembling the explosion of one of the so-called dynamite cannon crackers of medium size. As lightning goes, I suppose it was a mild discharge, but I felt quite thankful for the detaining question nevertheless. On examining the spot struck, I found three small patches of withered clover in a straight line about eighteen inches apart. At the center of the larger one was a hole in the ground perhaps an inch in diameter; a smaller hole about one-quarter of an inch across marked the center of the next patch, while the third showed no perforation of the soil. A closer examination showed that the sides of the hole were blackened, and covered with small white patches of grains of sand fused together. It seemed worth while to make a study of what had happened below ground, and I accordingly melted about fifteen pounds of solder in an iron pot, heating the metal considerably above its fusing point, and poured it into the hole until it overflowed. We then excavated the cast thus formed, taking great care not to bend or scratch it with the spade. We found a small lateral tube several inches below the surface, which joined the two holes, with a long rusty nail partially fused and polished lying in it. The presence of the nail in the soil probably caused the lateral discharge to bridge across between the two main ones. In digging out the cast we found a lateral tube branching out from the large one, running down in the same general direction, into which the solder had not penetrated.

AUTOGRAPH OF A THUNDERBOLT.

The cast was nearly four feet in length, and over an inch in diameter at the center, tapering off in both directions. What was especially interesting was the fact that it was *distinctly spiral*, a circumstance which has frequently been noticed in the case of fulgurites, or the tubes of fused sand formed when a heavy discharge of lightning strikes in a sand bank. Very little seems to be known as to the cause of this spiral structure, and this method of making casts of the tunnels formed by lightning may add in no small degree to our knowledge of the subject. On the day after the storm another and much larger hole was found on the golf links, where a very heavy discharge had struck a box of sand on one of the tees, so they are doubtless of very frequent occurrence. It is my hope that others will repeat the experiment; the services of the local plumber and his furnace can always be invoked in case one has not the facilities for melting the solder. It is important to find out whether the spiral form is the rule or the exception, whether the direction of the spiral remains the same throughout the entire length of the tube, and whether the twist is always the same. In the present case the direction of the twist was clock-wise looking downward, that is the fulgurite resembled a corkscrew driven down into the ground. The spiral form can be distinctly seen in the accompanying photograph of the cast, and is especially noticeable at the bottom. The entire surface of this cast is covered with small buds, arranged in straight lines along its length, some of these lines being seven or eight inches long. These may be due to cracks in the walls of the tube, due to the explosive action of the steam generated by the heat of the discharge.

Denatured Alcohol from Cacti.

BY P. E. M'CLENAHAN.

If the great Southwest is ever reclaimed and made to produce vegetation that will be profitable, it must be done by developing the native plants instead of attempting to introduce new species and trying to acclimate them. With this idea in view, the United States Department of Agriculture has been directing the experiment stations and encouraging work upon the cacti.

For more than six years the experiment station at Las Cruces, New Mexico, has been experimenting with the prickly pear and other cacti. This species has been planted, and it was found that by throwing it upon the ground 85 per cent of the pieces grew, while only 91 per cent of the parts planted in a furrow grew. The rows were planted ten feet apart, and then left without cultivation, irrigation, or attention for three, four and five years. By this time the rows had spread until they were from six to eight feet wide, and only left a small path between them.

Then began a large series of experiments. The fruit of the cactus (tunas) was gathered. It is almost as large as an egg, of a dark red color, and filled with seeds. The coloring matter was first extracted, and found to make an excellent fruit coloring for jellies and confectionery. Then the sugars were examined and six kinds were found, and after long, tedious processes, each sugar was fermented and in time turned into alcohol. Then came careful weighing and mathematical calculations to determine the amount of denatured alcohol that could be produced from an acre, and the minimum of cost.

Final deductions gave most satisfactory results, and it was proven that $150 worth of denatured alcohol could be produced per acre after an average growth of four years for the plants. At this rate a quarter section of now arid land could be made to yield a gross income of $24,000, and this would be almost a perpetual yield, as the fruit is borne annually, and the plants need no replanting, cultivation, or irrigation, and grow upon the poorest soil in the arid regions.

A NOVEL WIND WAGON.

At the Indianapolis Motor Speedway aviation meet, held last June, an Overland Wind Wagon was exhibited which attracted a good deal of attention. The car was one taken from a stock of sixty-seven others, produced at the factory on one day, immediately after they had returned from their road test and before they were painted and groomed. Everything was removed from the chassis back of the clutch. Instead of an ordinary rear axle with a differential, a plain, straight axle was substituted. A wooden propeller eight feet long was mounted in position. The driving shaft instead of running back to the differential on the rear axle, was extended straight back until it protruded about six inches beyond the seat. Here a silent chain, which ran upward about 2⅛ feet, connected it with another short driving shaft, the upper driving shaft extending back in the rear of the car and holding the propeller. The propeller made 750 revolutions per minute. Its pitch and diameter were about 9 feet. The weight of the car was 1,800 pounds, and the motor was of 40 horse-power.

At the Indianapolis Motor Speedway, in competition with Walter Brookins in a Wright aeroplane, this wind wagon, driven entirely by the propeller, with Carl Baumhofer at the wheel, made the new time for 5 miles of 5 minutes and 20 seconds. The driving sprocket has 17 teeth and the driven sprocket has 31 teeth.

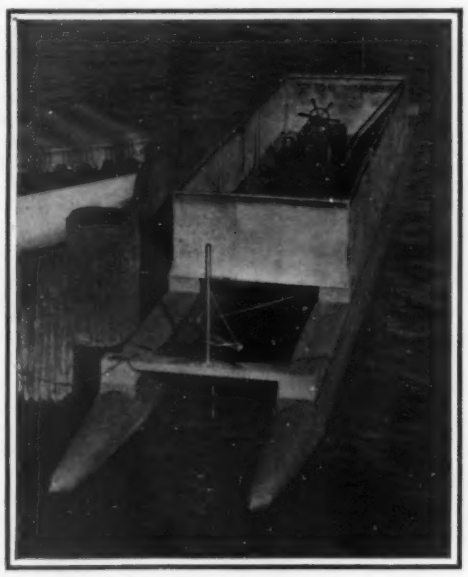
A NOVEL WIND WAGON WHICH HAS A SPEED OF NEARLY 60 MILES AN HOUR.

A TUBULAR HIGH-SPEED CATAMARAN MOTOR BOAT.

BY FRANK C. PERKINS.

A novel tubular power boat, which draws only two inches without load and three inches with several passengers, has been constructed by William S. Reed, of Janesville, Wis. It has a speed of 18 miles per hour when operated by a gasoline motor of only 6 horse-power capacity.

The boat consists of two cigar-shaped tubes measuring a trifle less than one foot in diameter. On the tubes a platform 14 feet long is mounted, which has a railing of tubing with paraffin-coated canvas sides and ends, secured by a molding at the bottom and hooks on the railing.



A TUBULAR HIGH-SPEED CATAMARAN MOTOR BOAT.

The platform on which the engine is mounted is 3½ feet wide, and is made of matched flooring. The boat measures about 30 feet in length over all. The galvanized-iron cylinders or tubes are divided into three chambers, an air pump keeping a moderate pressure constantly within them.

The rudder is located at the bow between the tubes. By this arrangement the boat is steered with little loss of speed in turning, the usual result when the rudder is placed at the stern. The boat attains its highest speed in a remarkably short space of time.

It is said that this novel motor boat leaves hardly any wake and that it throws only a three-inch wave, for this construction gives the propeller an undisturbed body of water to pass through at all times.

It is maintained that the stern does not settle down in the water, even when running at full speed. The skin friction is small.

In a paper entitled "Reinforced Concrete Trestles," which was read some time ago, it is stated that as yet, no soil has been encountered in which wooden piles could be driven, in which it has not been possible to drive the concrete piles. In some soils it is expedient to employ a jet; in others, an ordinary drop hammer, a steam hammer, or a combination of the jet with one or the other forms of hammer. It is necessary to lift the drop hammer somewhat more slowly for the concrete pile than for the wooden pile, in order not to set the driver into vibration. A cushion of some elastic material must be placed between the hammer and the pile, and with this precaution very little damage to the head of the pile results, even after long continued driving. As a matter of fact, it is surprising how much punishment a well-seasoned pile will stand. When it is necessary to drive the pile below the leads, as is generally the case, the follower is placed on top of the cushion. As the loads on these piles are great it is necessary to drive them to refusal, so that accurate knowledge of the required length is necessary. In case it is found that the piles so driven do not reach the elevation called for on the plans, the depth of the cap is increased accordingly. If it is found impossible or impractical to drive the piles to the depth anticipated, they can be cut off without difficulty. The cut need not be a smooth one, as the casting of the cap will take care of irregularities of the head of the pile.

A DINOSAUR SKELETON WITH SKIN, 3,000,000 YEARS OLD.

BY BARNUM BROWN.

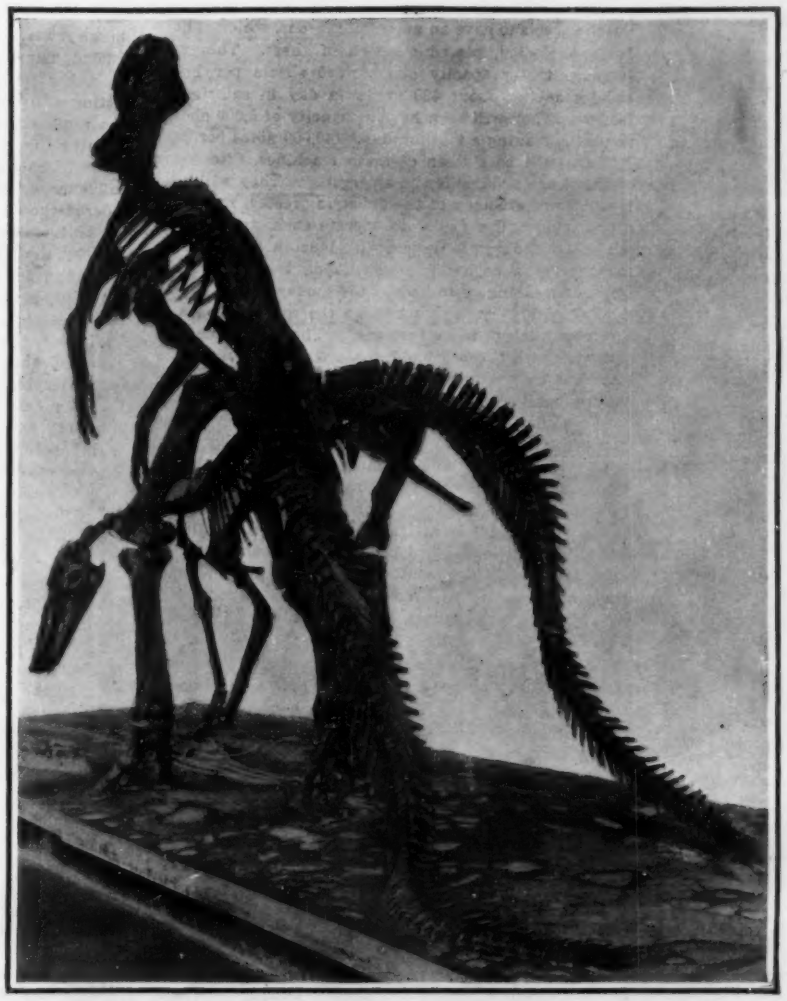
Nearly complete skeletons of duck-billed dinosaurs have been found, some with fragments of the epidermis also preserved. Not long ago two were mounted in the American Museum of New York city, an account of which appeared in the SCIENTIFIC AMERICAN for April 11th, 1908.

A third specimen, incased in nearly complete epidermis, has just been added to the collection, thus completing our knowledge of these interesting creatures, so that few, if any, of the extremely ancient prehistoric animals are at present as well known as the members of the family Trachodontidæ.

These creatures in slightly modified forms are found in the rocks of several geological formations, covering a long period of the earth's history, but all became extinct at the close of the Laramie Cretaceous period, conservatively estimated to be three millions of years ago. They were not exclusively American, for a few representatives have been found in rocks of the Wealden age in England and Hungary. But they reached their maximum development in America, where they were widely distributed over the eastern and western United States and southwestern Canada.

Plant remains, leaves, fruits, and wood are sometimes found with the fossilized bones, and by comparing them with modern plants, we are able to determine with considerable accuracy the climatic conditions of the past geologic age. Palm leaves, fig fruits, and banana leaves have been found with Trachodons in Montana, which show that the climate of the United States, as far north as Canada, was warm temperate to sub-tropical at the close of the Cretaceous period.

The Trachodons were aquatic dinosaurs, and spent most of their lives in fresh water lagoons, which were then abundant over the low interior lands. Their remains have also been found in sea deposits that were formed near the shores. It is not a difficult matter to picture one of these sylvan marshes of the Cretaceous period with stately palms bordering the lakes; the rapacious Tyrannosaurus, king of the flesh-eating dinosaurs, lurking among the trees to capture a meal; the Trachodons disporting themselves out in deep water, their only safety from foes.



Trachodon group. Three-quarters rear view. Tendon bones preserved as found along tail of the erect specimen.

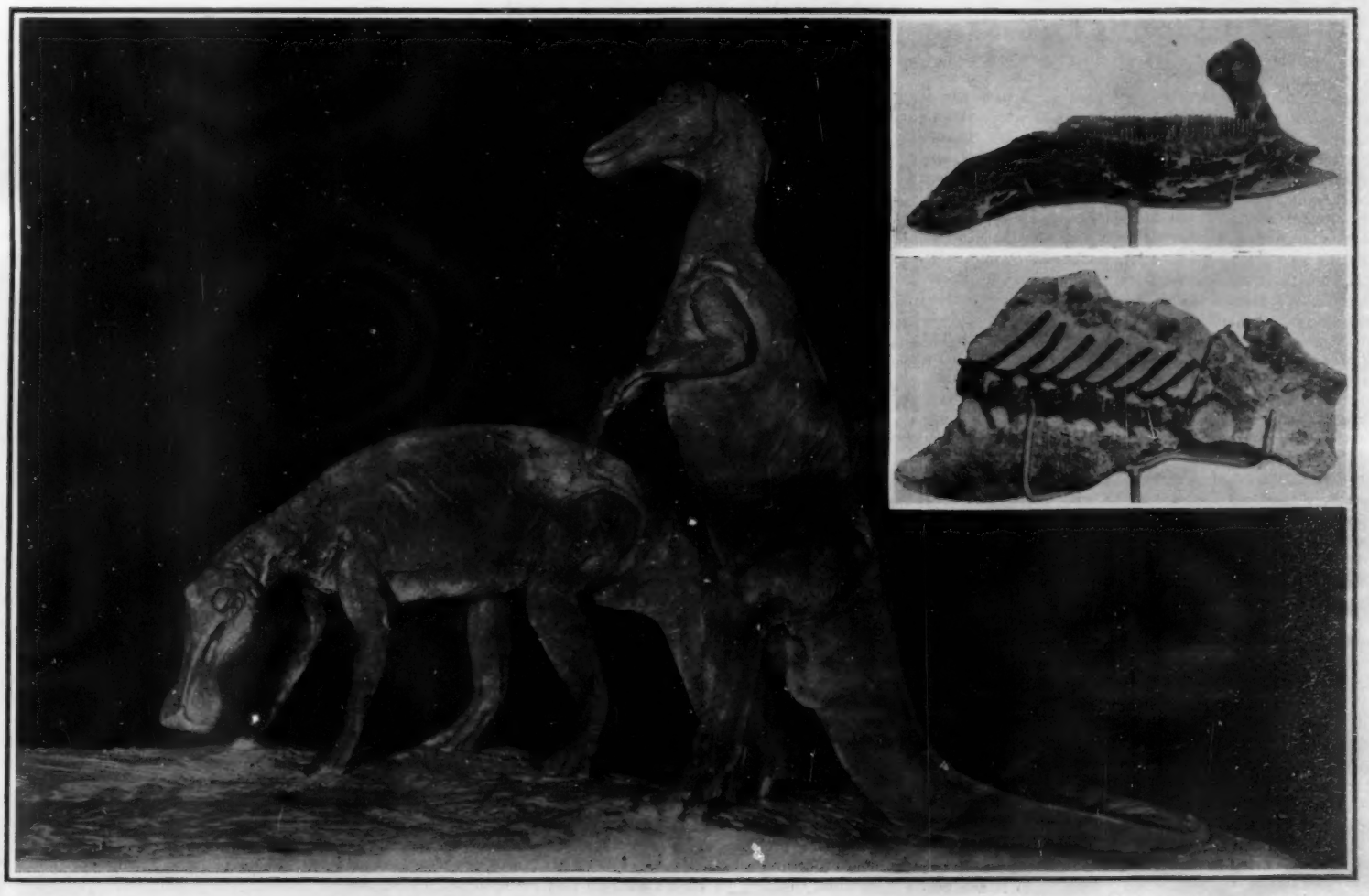
The numerous remains of these huge creatures that have been recovered attest their great numbers during life. A comparative study of their anatomy leaves little doubt that they were oviporous; that is, reproduced from eggs, which may well have been hatched in the warm sands bordering the shores.

They combine some anatomical characters of both lizards and crocodiles, but have no near living relatives and left no descendants. They were kangaroo shaped, with long hind legs and reduced fore legs and a long deep powerful swimming tail. The peculiar expanded beak, resembling a duck's bill, was covered by a horny mass, denticulate in form, which was undoubtedly used in gathering its vegetable food, the nature of which is still conjectural. The teeth, situated farther back in the jaws, are the most highly specialized of any known. There were about 1,000 altogether, massed in a solid pavement; that is, about 500 in each jaw, distributed in 45 to 60 vertical rows, according to age and species, with from 10 to 14 teeth in each row. The teeth have enamel on one side only, the inside of the lower and the outside of the upper jaw, so that the enamel edges on the opposing jaws passed across each other obliquely, like the blades of shears, and were used apparently to cut the food in sections.

There is reason to believe that this group of dinosaurs at least swallowed stones like birds, which aided in grinding their food.

The new specimen is unique in many ways, and adds much to our

(*Concluded on page 75.*)



Trachodon group restored.

Trachodon lower jaw with pavement-like mass of teeth. Trachodon tail partly covered with fossil skin.

A DINOSAUR SKELETON WITH SKIN 3,000,000 YEARS OLD.

Our New Currency Machines.

BY THOMAS GANNAWAY.

The Director of the Bureau of Engraving and Printing, Mr. J. E. Ralph, is having some machinery installed in his department which is going to save the government many thousands of dollars annually on the cost of the preparation of our paper currency alone.

It has not, until very recently, been the custom to print the United States seal and the Treasury numbers on gold certificates, silver certificates, and Treasury notes, at the Bureau of Engraving and Printing. Without these, they are worthless. It was the custom, however, to take the sheets, which contain four notes each, and pass them, one at a time, through a trimming machine which trimmed them on two sides only and then put them in packages of one thousand sheets each and to deliver them to the Treasurer in the Treasury Building. Here they were fed through presses, similar to ordinary job printing presses, which printed the United States seal and Treasury numbers on them; then they were put into a separating machine, which trimmed the ends of the sheets and cut apart the four notes.

FORTY NEW TRIMMING MACHINES.

The forty new trimming machines which are now being installed at the Bureau are so constructed that they trim all four sides of the sheet at once. The knife is about one inch wide and is in the shape of a rectangular frame, and is arranged so that the operator slips the sheet under it onto the die with her right hand, reaches with her left hand over one side of the knife into the rectangle and places the sheet in the proper position, then while she still holds it, with a slight pressure of her foot, the machine working automatically, makes one stroke, and the four sides are trimmed. The operator immediately releases her hold, and the sheet is carried into a receptacle for receiving it. This machine is run by electricity, and occupies about one-third of the space the old ones did. One girl will trim an average of 7,000 sheets on four sides in seven hours, while with the old machines it required two girls to trim 8,000 sheets on two sides in the same length of time.

THE NEW COMBINATION MACHINES.

The money is carried from these trimmers to the new combination machine, which is a marvelous piece of mechanism. It is very compact, being only about one-half as large as it seems that it would have to be to contain the many distinct features which it does. It is only about three feet wide, four feet long, and four feet high. The trimmed sheets of four notes each are fed endwise into this machine at the rate of about 4,000 per hour. It prints the United States seal and the Treasury numbers on each note, and then they are as "good as gold." The Treasury numbers must run in numerical order, hence they are different on each note. Example: Suppose they were beginning with No. 1, the notes on the first sheet would be numbered 1, 2, 3, 4. Next the machine separates them, and moves them out endwise to one side on four small planes just large enough to hold one note each. These planes are placed side by side and slightly elevated, so that one side of each extends just a little above the lower edge of the one next to it. There are two grooves running crosswise of the four planes. As soon as the four notes are carried onto these four planes, there is a little rake with two tines running in the two grooves which pulls note No. 4 off its plane and drops it on top of No. 3, then notes No. 4 and No. 3 are both pulled off onto No. 2, likewise the three are dropped onto No. 1; the four are then dropped into a compartment much lower than plane No. 1. Here they are held for others to be stacked with them. The next four notes are numbered 5, 6, 7, and 8, and are stacked in the same way and automatically dropped on top of the first four, and so on until this stack contains 100 notes. When this process has been repeated the twenty-fifth time, the stack, then containing 100 notes, is automatically released and carried under the four planes back to the front of the machine and dropped. Here they receive the first human touch since the original sheet was fed in at the top.

EXAMINATIONS OF THE NOTES.

The first inspector receiving them examines the first four and the last four notes to see that the numbers started and ended correctly. By the time she does this (and she must do it quickly) there is another 100 ready for her. She then passes them on to another inspector, who examines every note to see that the seal and numbers are properly placed on each. Each inspector after having examined the 100 notes places a paper band around them and puts her name on it, and she is held responsible for the correctness of that particular package until it has been received and inspected in the Treasurer's office. It requires seven girls to examine the work of one machine.

Each machine is placed in a wire cage to itself, and no one except the employees belonging to it are permitted in that cage. Off a little way from this cage is a wire screen, beyond which the public is not permitted to go. These employees are charged with all the money which goes into their cage, and are not allowed to leave it without a pass.

AUTOMATIC FEEDER.

Soon after the installation of these machines is completed (which will be some time in July, 1910), Mr. Ralph expects to have an automatic feeder, which is now being perfected, placed on each of them. This will increase their capacity about 1,000 sheets per hour, besides saving about $30 or $40 a day in salaries of feeders. They will then have a capacity of 5,000 sheets per hour, making a total of about 140,000 notes per day.

There will be sixteen of these machines, fifteen for constant use and one for an emergency. They will take the place of nineteen of the old-style presses, requiring a pressman and a feeder to operate each, and twenty-six of the old-style separating machines, requiring three persons each to operate them, besides a large corps of messengers to handle the money. This makes a total of 114 employees besides the messengers, and the money is yet to be inspected. The new machines, equipped with the automatic feeders, will do this same work and only require one man with each machine, besides a small corps of messengers.

The saving in the expense of preparing our paper currency alone will be $180,000 annually.

This change in the system of finishing the paper money greatly increases the responsibility upon the Director of the Bureau, as heretofore none of it was completed there. But Mr. Ralph seems to willingly bear this additional burden, and at the same time is well pleased with the results of his reformatory efforts. The whole country will feel the effects of such efforts, and should congratulate Mr. Ralph for his great achievement.

The 1910 Glidden Tour.

The annual tour of the American Automobile Association has been run under various conditions since its inauguration, but in recent years it has developed into a trade means of arousing an interest in the automobile. It is natural, therefore, that the route chosen should lie through sections of the country that have not been developed as markets, and it follows that these are the sections that will be benefited by the good roads propaganda, the spreading of which is the secondary object of the tours.

The 1910 tour covered a distance of 2,851 miles, and starting from Cincinnati, O., led through Kentucky, Tennessee, Alabama, Mississippi, Arkansas, Texas, Oklahoma, Kansas, Missouri, Nebraska, Iowa, and Illinois to Chicago, where it disbanded. The Glidden trophy, from which the tour takes its name, was as usual competed for by touring cars, while the Chicago trophy was offered by the runabout or miniature tonneau car making the lowest score. Competition was limited to cars of strictly stock models, and in order to assure this, the makers were required to file sworn statements of the types, dimensions, equipment, etc., of their product. The competing cars were delivered to a technical committee some days before the start of the tour, and were checked against these records. This is but one example of the strictness of the rules, which were intended to assure an exact knowledge of any defects or derangements that might appear.

The cars were subject to penalization according to a point system that took mechanical failures into consideration, as well as arrival at a control at any other than a specified time. All possible accidents to the mechanism or appurtenances of a car were listed at the beginning of the tour, a penalty being fixed for each, and these penalties varied from one point for a leaky oil or water connection to 500 points for a break in the steering apparatus or of a frame side-member. Carbureter adjustments, spark-plug changes, and attention to the lubrication of the mechanism were permitted during one-half hour at the night stops, while brake adjustments were allowed at only two points on the route. It was assumed that beyond these a car should require no attention, and all other work was therefore penalized. Each car carried an official observer, and in addition to this, the bonnet, gear case, differential housing, and other parts of the mechanism were sealed. As the tool boxes and bags also bore seals, the officials were reasonably sure of being informed of any work required by the mechanism.

The running time between controls was set at 20 miles per hour for the Glidden trophy cars, and 18 miles for those competing for the Chicago trophy. The time when a car left a control therefore established its time of arrival at the following control, and any time lost on the road was charged for at the rate of one point per minute. The only exception to this was in the case of tire trouble, which was not charged for if the engine was kept running while the repair or replacement was being made. In view of the importance of the tire problem to the automobile industry, it seems unfortunate that advantage is not taken of the opportunity offered by such a tour as this for a comparison between the various makes of tires on the market. While it would perhaps be unfair to penalize a car for the failure of its tires, some consideration should be given to the subject, and whether or not a certain make of car is easy on its tires is a point of interest to the purchaser.

The list of entries was striking, for nearly one-half of the makers represented are newcomers to the industry, and most of the cars were of medium price and horse-power. In former years, the entry list has included many makes of high-priced and high-powered cars, but in the 1910 tour there were but two cars listing at over $3,000. One explanation of this is in the route chosen, which was through a section of the country that is not a logical market for cars of high price. The roads traversed undoubtedly exercised an influence on the manufacturers, who may have considered the advantage of a light car in sand and mud. As it turned out, however, the Glidden trophy was won by the 6-cylinder Premier, which headed the list for price, power, and weight.

Twenty-seven cars started on the tour, of the following makes: Cartercar, Chalmers, Cino, Cole, Falcar, Lexington, Maxwell, Ohio, Moline, Parry, Pennsylvania, Premier, and Westcott. These were accompanied by cars carrying the officials and correspondents. Two Cadillac cars entered by the Northwestern Military Academy attracted attention, as they were equipped with rapid-firing guns and designed for scouting work. The cars were manned by students from the academy, in command of one of their officers, and the tour gave the detachment practical experience in the military possibilities of the automobile. The equipment of these cars included tents and a camping outfit, and the nights were spent under canvas.

The average day's run was 198 miles, the longest being 242 miles and the shortest 60. In view of the road conditions encountered, this mileage is extraordinary, and the ability of some, if not all, of the cars to keep to the schedule is a convincing manifestation of the excellence of the modern automobile.

In the tours of previous years the penalties imposed were chiefly for engine troubles, and it is of deep interest to note that this year, in spite of the severity of the conditions, engine failures and derangements were rare. This not only indicates an approach to perfection in design and construction, but very great improvement in carbureters, spark plugs, pumps, lubricators, and other accessories. On the other hand, failures of all parts of the running gear were so frequent that the manufacturers cannot but be impressed with the imperative necessity for a deeper study into these parts. An engine failure will do no more than delay the progress of a car, but a mishap to the running gear endangers the lives of the occupants, and should be guarded against at all cost.

The most serious of these troubles, so far as the safety of the user of a car is concerned, lies in the steering gear, and it is disquieting to note the number of penalties that were imposed for the failure of this part. Broken steering knuckles and steering-gear arms were by no means infrequent, and as in many cases these parts are purchased from concerns specializing in their manufacture, it is to be hoped that the lessons of the tour will be studied and applied. Steering gear troubles, as well as broken and sprung axles, the loosening of wheels, the breaking of springs, and corresponding difficulties, led to the expression of dissatisfaction with the selection of the route; but from the point of view of the automobile user, and for the improvement in construction that is bound to result, the selection was most wise.

The difference between the 1910 tour and the tours of previous years is shown by the fact that when the cars drew into Chicago on the sixteenth and last day, all were penalized more or less severely, and sixteen had dropped out. The awarding of the trophies was not based on these scores only, however, for the cars were required to pass through a final technical examination that in many respects was one of the most interesting features of the contest. The first step in this was the testing of the brakes, the basis of which was the supposed ability of either the foot or the hand brakes to stop the car within fifty feet, the car running at 18 or 20 miles an hour, according to its class, when the application was made. The car approached a mark in the road at the running speed, and if it passed a second mark 50 feet in advance after the brake was applied, it was penalized at the rate of one point per foot.

As a test for the clutch, the front wheels were held against an 8-inch curb, the engine speeded up, and the clutch applied. If the wheels climbed the curb, if the rear wheels were slipped, or if the engine was stalled, the clutch was considered to be in perfect condition. After these tests the cars were delivered to the technical committee for a searching examination into every detail. The eleven cars were penalized in this on 72 counts; 38 of these were for defects in the running gear, and but 8 for defects in the engine.

The final scores in the Glidden trophy division were as follows: Premier, 93; Chalmers, 116; Maxwell, 208; Premier, 806; Glide, 2,247; Cino, 2,414. In the Chicago trophy division the penalties were not so severe, which may be due to the lower rate of speed

that was required. The scores were as follows: Moline, 19; Maxwell, 51; Moline, 64; Moline, 481; Lexington, 2,142. The trophies were accordingly awarded to the Premier and Moline cars.

The economic value of good roads is unquestioned, and the missionary work accomplished by such a tour as this cannot be over-estimated. The path-finding car that laid out the route carried an official who appointed local committees for the improvement of the roads selected, and in many cases these men took up the work with an enthusiasm that will continue to bear fruit long after the tour is forgotten. When conditions permitted, these committees made use of the King drag, and if nothing more could be done, holes in the roads were filled with broken stone. This played havoc with the tires, but indicated a gratifying tendency toward the betterment of conditions. While the annual tour is an expense to the manufacturers, and imposes a great physical strain on all connected with it, yet its influence on the improvement of automobile design and construction, the fields of commerce that it opens, and, most important of all, its effect in the extension of the cause of good roads, should make its continuance a duty that should receive the heartiest support of the automobile industry.

Johann Gottfried Galle.

On July 10th Johann Gottfried Galle, the German astronomer, who was the first to see the planet Neptune, died at Potsdam.

The discovery of Uranus was the triumph of the telescope. The discovery of Neptune was the triumph of mathematics. In fact, when the French mathematician Leverrier, at Paris, wrote to Galle at Berlin, substantially as follows, "Direct your telescope to a point on the ecliptic in the constellation of Aquarius in longitude 326 deg. and you will find within a degree of that place a new planet looking like a star of about the ninth magnitude, and having a perceptible disk," the German astronomer, within thirty minutes after he had begun his search, on the night of September 23rd, 1846, was able to find the new planet, but fifty-two minutes distant from the point indicated by Leverrier.

Between 1839 and 1840 Galle discovered three comets. He was the first to advocate the use of planetoid observations for the determination of the solar parallax, now considered the best method. In 1888 he made some interesting observations of Saturn. The Lalande prize for scientific work was twice awarded to him.

His works include "Abhandlung über die leichteste und bequemste Methode die Bahn eines Cometen zu berechnen" (1847 and supplemented in 1864 and 1885). This work contains the orbits of 175 comets. "Grundzüge der schlesischen Klimatologie," 1857; "Ueber die Verbesserung der Planetenelemente," 1858; "Ueber Bestammnung der Sonnenparallaxe," 1875; "Mitteilungen der Breslauer Sternwarte," 1879, and "Verzeichniss der bisher berechneten Kometenbahnen," 1894.

He was born at Pabsthaus, Prussia, in 1812 and educated in Berlin.

The Current Supplement.

The opening article in the current SUPPLEMENT, No. 1803, deals with the Hittite stele from the environments of Restan, and with Hittite monuments of Arslan Tépé.—The study of astronomy has afforded few revelations more wonderful and interesting than those relating to Sirius, "the king of suns." Mr. Arthur K. Bartlett describes the famous Dog-Star—Mr. A. Livingstone Oke, M.E., gives some useful knots for engineers.—There are to-day numerous experimenters who desire to own a thoroughly up-to-date and efficient wireless station, but who have not the means to purchase the necessary equipment. For these, Mr. Edward H. Guilford describes how a 1,000-mile receiving station can be constructed.—Dr. Wilhelm Ostwald, the distinguished German chemist, points out certain peculiarities of machines by reference to facts which are well known and familiar in connection with living creatures.—Recent progress in aviation is reviewed by the Nestor of aviators, Octave Chanute. His is the most complete and up-to-date article on the subject which has thus far been printed.—Mr. Thaddeus S. Dayton gives some interesting facts on New York skyscrapers.—Mr. A. H. Heller describes the Verneuil process of making sapphires synthetically.—How to test seeds for corn in school is told by Mr. A. C. True of the United States Department of Agriculture.—Mr. Albert Moyer excellently describes the effect of sodium silicate mixed with or applied to concrete.

The British consul at Wuhu reports that the Wuhu Electric Light Company, which is Chinese owned and under Chinese management, commenced operations in May, 1909, and now maintains a regular supply to some 4,000 lights in the native city. Additional machinery has lately been imported, with a view to providing a night and day supply, and a scheme is on foot to make use of electric current as the driving power of the rice cleaning machinery in one of the local mills.

Correspondence.

EXPERT SUGGESTIONS AND COMMENTS ON THE RULES FOR THE GOULD-SCIENTIFIC AMERICAN MULTIPLE-MOTOR AEROPLANE PRIZE.

To the Editor of the SCIENTIFIC AMERICAN:

Your letter regarding the rules for the prize offered by Mr. Edwin Gould came during my absence from the city. The only suggestion I have to make is that in my opinion the word "connected" in fourth line, paragraph 1, should be stricken out and the word "arranged" substituted, and that the word "together," last word of same paragraph, be stricken out and the word "simultaneously" substituted therefor. I can see no reason why they should be connected, provided they can be worked either separately or simultaneously.

Should an engine builder who is not an aviator wish to compete, we think they should make arrangements with some one who has a machine and is competent to fly it to demonstrate his engine and plan of transmission.

WILBUR WRIGHT.

Dayton, Ohio.

To the Editor of the SCIENTIFIC AMERICAN:

I beg to acknowledge your letter of June 20th, with inclosure, relative to the Gould prize, and regret that lack of time has prevented my giving it earlier attention.

I think you have drawn up an excellent set of rules, and believe they meet the requirements very well. As for a machine being barred because the inventor has not the experience to fly it, is concerned, I believe there will be no difficulty on that score. However, I have indicated a change* in the wording of paragraph 5, so that the inventor may have someone else operate his machine for him. Mr. Gould has stipulated that his prize is for the most perfect and practicable machine. It must be flown to prove it is practicable. By July 4th, 1911, there will be so many aviators, that is, licensed pilots, that there should be no difficulty in securing a pilot for any machine that may be built. Moreover, it seems probable that competing machines will be of the well-known types we now have, for which there is no lack of pilots, or if they are new types, they will have similar controlling mechanism to the present machines.

Under paragraph 8 I would offer the suggestion that "no entry fee be charged, but the contestant must pay the expense connected with the trials, must transport his machine to and from the field of trial, provide his own fuel, oil, etc., but the field and suitable sheds for housing the machines will be provided by the committee."

By July 4th, 1911, no doubt there will be numerous aviation fields throughout the country, with suitable sheds, which can be secured for the purpose of holding the trials.

I hope Mr. Gould's offer may bring forward many contestants, and that we may see evolved a machine fulfilling the conditions and having that very necessary requirement of "reliability in the air," which is one of the weak points of machines now in use.

FRANK P. LAHM.
First Lieutenant Seventh Cavalry.

Fort Riley, Kansas.

To the Editor of the SCIENTIFIC AMERICAN:

I return herewith the rules governing the competition for the $15,000 prize, with my hearty approval. One suggestion has occurred to me and has been added as a foot note, which might be made a part of Section 2, as indicated. I shall be greatly interested in the outcome of the contest, and take this occasion to compliment the SCIENTIFIC AMERICAN on its great service to the cause of aeronautics.

A. F. ZAHM,
Secretary Aero Club of Washington.

Washington, D. C.

Mr. Zahm's suggestion is as follows: He must furthermore leave a certificate from an expert recognized by the Contest Committee, testifying that the two engines satisfactorily stood a test for a given time, working under normal full load, together or individually, and that the fluctuation of power did not exceed a certain per cent of its normal full load value.

THE FLIGHT OF PROJECTILES.

To the Editor of the SCIENTIFIC AMERICAN:

The common misconception as to the position of projectiles in flight arises from lack of understanding of what is called the "gyroscope principle." People use this term with the idea that it means a tendency on the part of rotating bodies to resist change of direction of their axes. But there is no such tendency. Force is necessary to change the position of a body, and the only difference between the case of a rotating body and one that is not rotating is that when force is applied to the latter, the resulting motion is in a different direction from what it is if the same force is applied to the former.

If there were no atmosphere, the axis of a projectile would remain parallel to itself throughout its flight, whether it were given rotation about that axis or not. It is the resistance of the air that makes a non-rotating projectile tumble end over end, and that keeps the axis of a properly rotated projectile in the tangent to its trajectory.

As soon as a projectile leaves the gun, its path, under the influence of gravity, begins to curve downward. The resistance of the air, which acts in the line of motion, therefore, soon ceases to be parallel to the axis of the projectile; and its resultant, meeting that axis between the center of gravity of the projectile and its point, tends to up-end the projectile. If now the projectile were not rotating about its axis it would simply be turned over, but, as it is rotating, it turns to one side; the right if the rotation is right handed. This is the true gyroscope principle—that the upsetting movement causes an angular movement at right angles to that which would occur if there were no rotation. It is not that it causes no angular movement.

Well, as may easily be seen, as soon as the axis swings to one side, the air resistance meets the projectile on the other side of the head, and so causes the axis to swing downward. The result is that the axis tends to describe a cone about the tangent to the trajectory, and is only prevented from doing so by the fact that this tangent moves constantly downward as the trajectory curves.

With properly rotated projectiles of the ordinary type fired from rifled guns, the axis of the projectile, due to this motion of precession, constantly hugs the trajectory, remaining practically coincident with the tangent to the projectile's path throughout the flight.

A very evident proof of this statement is as follows:

The values of the constants in the expressions for the resistance of the air to projectiles moving at different velocities have been determined by experiments that consist of firing through screens at short distances from the gun. In these experiments the paths of the projectiles are so nearly horizontal that they are certainly moving almost exactly point on. Now, when these constants are used for calculating the elements of long-range firing, angle of elevation, time of flight, etc., they give results that agree quite closely with the results of actual firings.

This proves that the resistance of the air throughout a very long curved trajectory corresponds with that which would occur were the projectiles always moving point on, which could not be the case if the projectile's axis remained parallel to itself.

Were the axis of a projectile as much as 5 deg. away from the tangent to its path, the surface exposed to the air resistance would be increased over 25 per cent above that exposed when it moved exactly point on, and the actual range would be far short of its value calculated by the usual ballistic tables.

Annapolis, Md. PHILIP R. ALGER.

* This change was incorporated in the rules published in our issue of July 9th.

Changes in the Patent Office.

A new Patent Office division has been created—fire extinguishers, baths and closets, sewerage, water purification—and placed in charge of Principal Examiner Disney, who was transferred from boot and shoe manufacture to the new division. The new Examiner appointed to the position created for July 1st, 1910, is Mr. Edward H. Eakle, promoted from First Assistant. Mr. Eakle has been in the Patent Office since about 1882, and has progressed through the grades. His last assignment prior to promotion was with Examiner Henry, Division XVII., where he had printing, especially the type-casting art. Before that Mr. Eakle had been in divisions having charge of metal-working and baling processes. He now has Division XI., leather working, boot and shoe manufacturing. Dr. R. C. Hyatt, for thirty years in the Patent Office and First Assistant in Division VII., died on July 11th. This will probably result in promotions all along the line.

A remarkable testimony to the mechanical strength of the tantalum filament is furnished by the behavior of two wire lamps which were in the center of an explosion in a works at Salford. A large still containing carbolic acid exploded, and the burning liquid spread in all directions. A fitting and lamps were fixed on the outside brickwork of the still, and were connected by means of overhead wires on insulators. The whole of the front of the still was blown out, and some of the brickwork was hurled a distance of twenty or thirty yards. The wires connecting the fitting, however, did not break, and pulled the insulators, fitting, etc., back into the *débris*, where it was found after the fire had done its worst. Although the fitting was badly damaged and burnt, and had been under water for two hours, the thick outer globes being broken to pieces, both of the lamps were intact when put on circuit. They fell about 15 feet, and as they had been in use about eight months, it is a remarkable proof of the strength of their filaments.

THE FIRST DREADNOUGHT.

To the Editor of the Scientific American:

In the November 20th number of the Scientific American was an article by me, claiming that the frigate "Roanoke" was altered into a dreadnought in 1863, and that she was the first of the type. In the February 19th number Mr. Percival A. Hislam replied, claiming that Great Britain had the honor, as the old frigate "Royal Sovereign" was altered like the "Roanoke," but in 1862-63, thus antedating the "Roanoke," though she carried one gun less, namely, five instead of six. On one of my walls hanging alongside of the lithograph of the "Roanoke" is another, of an ironclad called the "Onondaga," made for the Navy Department and presented to me in 1863 by the late Hon. G. V. Fox, the Assistant Secretary (a photograph of which I enclose).

As she had four guns, though antedating the "Roanoke," I did not make a claim for her in my article of November 20th, preferring to take the heavier ships, and not dreaming of any opposition to her; but as Mr. Hislam has put forward the "Royal Sovereign," I shall now enter the "Onondaga," to try to do him one better. Mr. Hislam only stated the year of alteration of the "Royal Sovereign," and as dates in this argument are important, I wrote to Lord Brassey, one of the best English authorities on naval matters, to get all the particulars about her he had and certain dates. He looked up several authorities for me, and I quote his reply:

"The exact date—day and month—of the conversion of the 'Royal Sovereign' is hard to determine. The time occupied in the conversion was long and the cost great, and took place between 1862-64. The vessel made her official trial of speed and power of circling, with full and reduced steam pressure, in Stokes Bay in June, 1864. The speed after conversion at the measured mile was eleven knots. In July she began a series of experimental firing trials off the Isle of Wight, which were continued throughout the autumn off Portland harbor. She does not appear to have ever been a fully commissioned seagoing ship afterward, being principally used as a tender to the 'Excellent.' Her only officers were a staff commander and chief engineer 'borne in "Excellent."' No sails were carried on her three pole masts after conversion. She was armored all over. Her sides were composed of three feet of solid timber, strengthened internally by diagonal iron bands, and clothed externally to the usual distance below the water line with 5½-inch rolled armor plates."

It will thus be seen that both the "Royal Sovereign" and the "Roanoke" were frigates altered into dreadnoughts, the former, however, carrying one gun less.

Now the "Onondaga" was not an altered vessel. She was authorized and absolutely laid down as a dreadnought. The Secretary of the Navy sent a communication to the House of Representatives dated December 1st, 1861, asking for "the immediate construction of twenty-one ironclad steamers." The House promptly responded to this recommendation, and passed a bill "authorizing and empowering the Secretary of the Navy to cause to be constructed, by contract or otherwise, as he shall deem best for the public interest, not exceeding twenty-one, etc., iron-clad steam vessels of war." Among these was the high-freeboard "Onondaga," the only one, as far as I know, of this type. The rest were the bow-freeboard monitors, the "Manhattan," "Tippecanoe," "Dictator," "Weehawken," and vessels of other types. It is, therefore, fair to assume from the wording that this bill was passed for the "Onondaga" the first week and not later than the second in December, 1861.

Now the "Royal Sovereign" and "Roanoke" were altered vessels, but here is a bona fide ironclad dreadnought authorized as such at the start, the year previous to the altering of the "Royal Sovereign," although carrying one gun less.

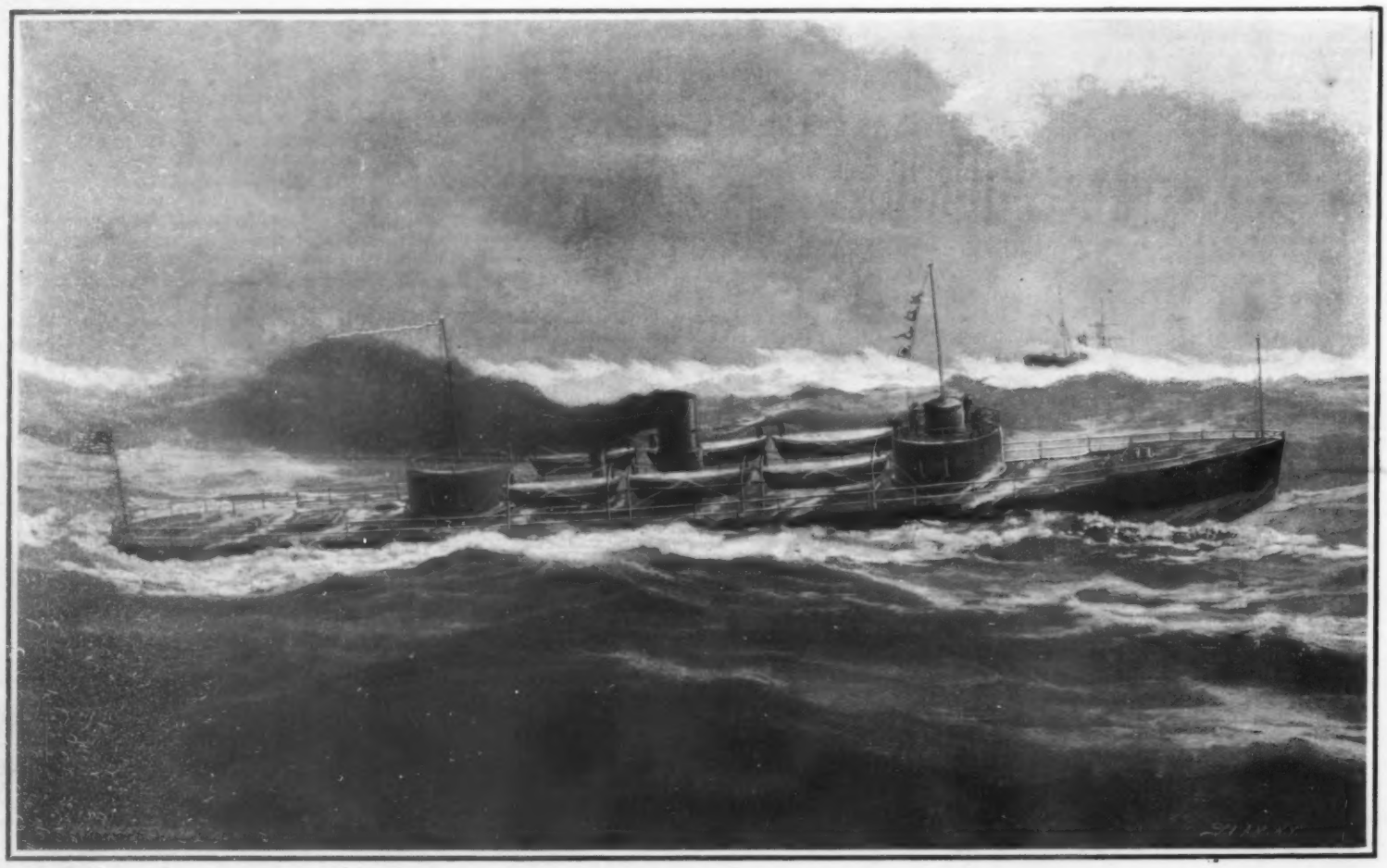
The "Onondaga" was built at the yard of T. F. Rowland of the Continental Iron Works at Greenpoint, Long Island; George W. Quintard, proprietor of the Morgan Iron Works, New York, being the contractor for the hull and machinery. The "Onondaga" was of 1,250 tons; length, 228 feet; beam, 50 feet; had four propeller engines, the diameters of whose cylinders were 30 inches, with a length of stroke of 18 inches. Her hull was armored for its whole length. In a letter from Admiral W. L. Capps, chief constructor United States Navy, in charge of the Bureau of Construction and Repair, to whom I am indebted for some of the information herein contained, he writes: "In accordance with an act of Congress dated March 2nd, 1867, the 'Onondaga' was returned to George W. Quintard, on payment by him to the government of $759,673, being the amount received by him for building said vessel. After the transfer of this vessel to Mr. Quintard, it was sold by him to the French government, where (its name having been changed) it served for years in the French navy."

It will thus be seen that the "Onondaga" antedates the altered "Royal Sovereign" and "Roanoke," and was absolutely laid down at the start as an armored vessel having, though smaller, the properties of the dreadnought.

I beg to acknowledge besides the kind assistance of Lord Brassey and Admiral Capps in this matter (a number of details given and not used here, as it would make the article too long) that of Messrs. Schaefer and Fisher of the Bureau of Construction and Repair.

William Boerum Wetmore.

Allenhurst, N. J.



Authorized by Congress in 1861. Length, 228 feet. Beam, 50 feet. Tonnage, 1,250. Carried four heavy guns.

THE IRONCLAD "ONONDAGA"—THE FIRST DREADNOUGHT.

AEROPLANE FATALITIES.

The year 1910 is destined to go down in aeronautical annals not only as a year of wonderful achievement in aviation, but one of tragedy as well. In the first half of the year more fatal accidents have occurred than in all the previous history of aviation put together, not because the machines were more poorly constructed or the men were more reckless, but largely because more men were flying.

One of the most lamentable fatalities was the death of the Hon. C. S. Rolls on July 12th last at Bournemouth, England. Captain Rolls was the hero of the recent double-channel flight from Dover to France and return, and was by far the most skillful of English aviators. The cause of the accident is as yet unknown, but was probably due to defective framing. He was flying in a Wright biplane. The newspaper dispatches, on which we must rely at the time of going to press, simply state that his machine suddenly buckled while 40 feet from the ground, and that he was dashed to death. We must await fuller details.

To enumerate all the accidents which have occurred since the days of Otto Lilienthal, which did not involve death, would provide an interminable list. We give below, however, a fairly complete list of those accidents which have terminated fatally:

September 21st, 1896, Otto Lilienthal was killed during a gliding flight at Rhinow, near Berlin.

October 30th, 1899, Percy Sinclair Pilcher, a pupil of Lilienthal's, was killed during a gliding experiment at Rugby. He fell from a height of 50 feet.

April 18th, 1905, an acrobat named Maloney was killed in Prof. Montgomery's glider in Santa Clara, Cal. The glider had been dropped from a balloon.

September 17th, 1908, Lieutenant Selfridge was killed at Fort Myer during a flight with Orville Wright. The machine fell from a height of about 75 feet. Orville Wright was painfully injured.

September 7th, 1909, Lefebvre was killed at Juvisy on a Wright biplane.

September 7th, 1909, Enea Rossi was killed at Rome while testing a machine of his own invention.

September 22nd, 1909, Captain Ferber was killed in his biplane at Boulogne-sur-Mer.

December 6th, 1909, Fernandez was killed at La Brague near Nice in a biplane of his own design.

January 4th, 1910, Leon Delagrange met his death by a fall in a Blériot monoplane at Bordeaux.

April 2nd, 1910, Le Blon was killed at San Sebastian, Spain, in a Blériot monoplane.

May 13th, 1910, Hauvette Michelin was killed at Lyons in an Antoinette machine.

July 3rd, 1910, Wachter was killed at Rheims in an Antoinette machine.

June 17th, 1910, Eugene Speyer was killed in a glider at San Francisco, Cal.

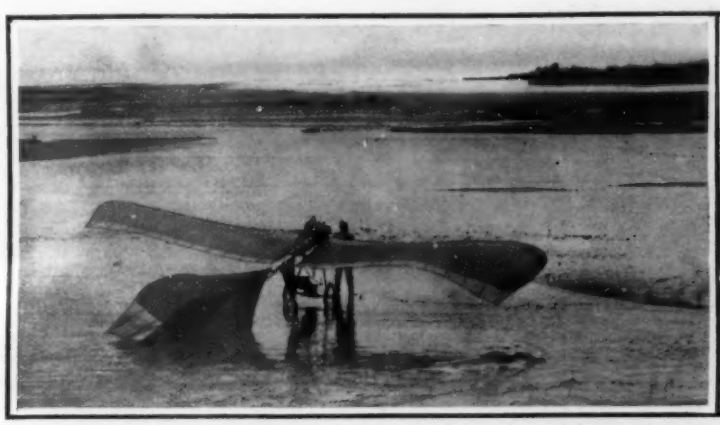
June 18th, 1910, Thaddeus Robl was killed at Stettin in a Farman biplane.

July 12th, 1910, the Hon. C. S. Rolls was killed at Bournemouth, England, in a Wright biplane of French construction.

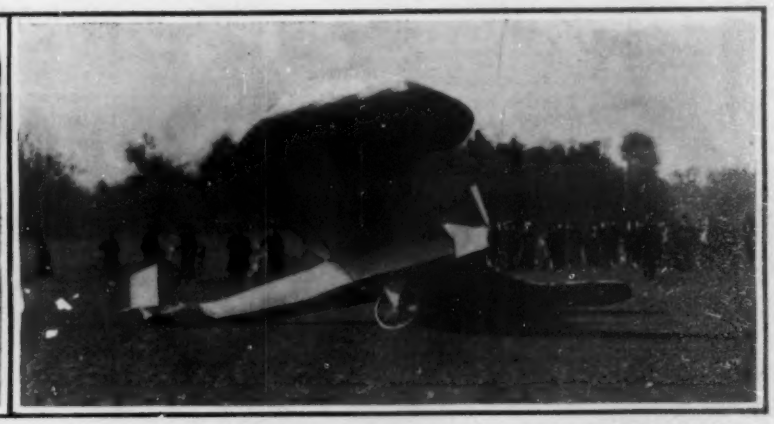
July 10th, 1910, Daniel Kinet, a Belgian aviator, dropped in a Farman machine from 300 feet as the result of motor trouble. He died five days later.

So far as we can judge at present, Captain Rolls met his death for much the same reason that Delagrange came to an end. In both cases the cause seems

(*Continued on page 74.*)



Grade's machine which came to grief in the Mediterranean Sea during the Nice meeting.



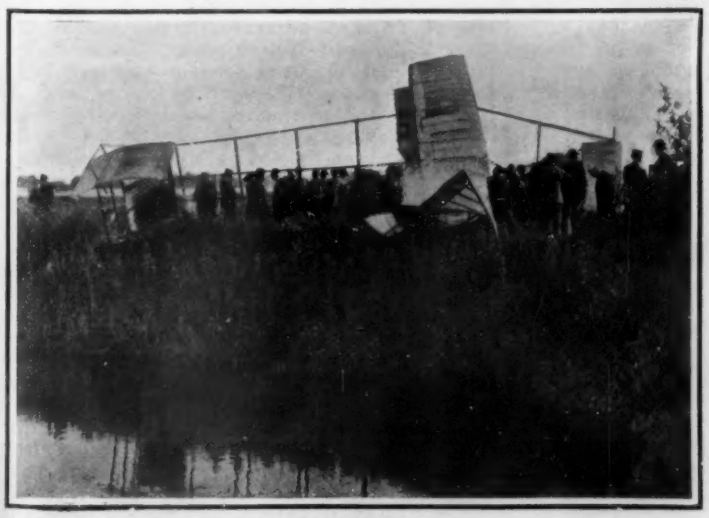
Blériot's No. 5. Blériot has had more accidents than all other aeronauts put together.

Wreck of a Voisin biplane at Betheny August 27th, 1909. The picture indicates that imperfect lateral stability probably caused the accident.

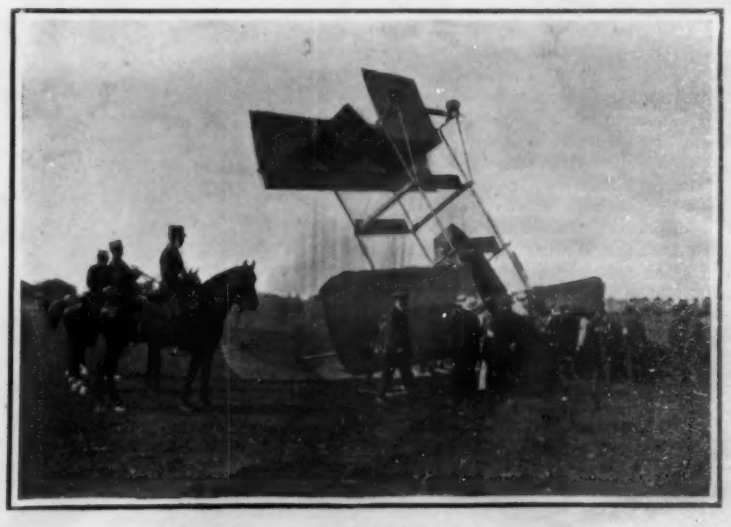
One of Delagrange's biplanes after a smash-up. The aviator was afterward killed in a monoplane.

Hauvette Michelin's machine at Heliopolis, Egypt. Michelin was killed recently.

De Baeder's machine. Artificial birds were not meant to perch on trees.



A wrecked Farman machine at Brooklands.



Breguet's biplane after a luckless downward plunge.

SOME AEROPLANE ACCIDENTS.

MAGIC FOR AMATEURS—III

SOME MYSTIFYING CARD TRICKS

BY W. H. RADCLIFFE

NO. 6. FLYING CARDS.

As no preparation is required for this trick it is a very convenient one to spring upon a card party during a pause in the game. From the full pack certain cards are selected by the performer which by reason of their design are not symmetrical. These cards, as shown in Fig. 9, are the aces, threes, fives, sixes, sevens, eights and nines of spades, clubs, and hearts, the seven of diamonds and the joker. If the picture cards are printed, as they often are, with unequal white borders at the ends or at the sides, they also may be used. These unsymmetrical cards are placed by the performer in a separate pack, the numbered cards with the unsymmetrical part pointing upward, the joker right side up, and the picture cards with the narrow end border nearer him or the narrow side border toward his right. The pack thus formed is handed around to be shuffled and cut. When the cards are returned to the performer he spreads them out fanwise in his hand faces down, and invites one, two or three of the party to draw one card each, to remember the card drawn, and afterward to replace it face downward in the pack. The performer meanwhile calls attention to the fact that the faces of the cards are not seen by him at any time during the trial after the cards have been shuffled and cut. However, after the cards have been drawn and before the pack is held out for their return to it, the performer unobservedly reverses the pack, that is, he turns it so the end which formerly was farther from him is now next to him, the faces of the cards being left downward as before. As this simple reversal of the pack is the key to the solution of the trick, it is necessary to draw as little attention to it as possible. If the movement be made while the performer is looking straight at the audience and cautioning them to bear in mind the cards drawn, there is little danger of its being detected. As those who draw the cards will, in practically every case, return them to the pack without changing them end for end, it is evident that if the pack is reversed as stated, the drawn cards can be easily detected from the rest of the pack by their changed positions relatively to the other cards. Careful shuffling and cutting will not alter this relation, but will add considerably to the effectiveness of the trick. It is, therefore, advisable to pass the pack around for this purpose before picking out the cards.

An effective method of producing the chosen cards consists of first arranging them together on the top of the pack, face downward with the others. Then raise the pack by taking its ends between the thumb and fingers of the right hand, about two feet above the table, allowing the top card to project at one side about one inch beyond the others. When the pack is released the retardation offered by the air against the under protruding side of the top card will cause this card to make a half turn in its descent, turning it face upward and causing it to fall beyond the others, which will remain together faces downward. Repeating this with the remaining top cards chosen will bring the trick to an appropriate close.

NO. 7. A CARD SHOOTING TRICK.

This trick may be introduced as the "twentieth century edition of the original William Tell's apple-shooting stunt." It requires the following preparation:

A heavy black cloth target fifteen by eighteen inches in size, as shown in Fig. 10, is first provided. It is made from two pieces of cloth, each of the size mentioned, placed one upon the other and sewed together with black thread around the upper half and across the center, as indicated by the broken lines *c*. The line of stitching across the center serves as a hinge upon which the lower half of the outer cloth can be swung up and held, thus making it conceal the three cards *a*, *c*, and *s*, which are glued in place as shown. In order that this lower half quickly returns to its normal position when released, a light iron rod should be inserted in a hem *r* formed along its lower edge.

Duplicates of the three cards glued to the target must be forced upon the audience. This is readily done by repeating the method previously described in Trick No. 3 with the three lower cards in a pack, these cards of course being duplicates of those on the target. As each selected card is held up to the chooser for identification, let him withdraw it from the pack and keep it hidden from the performer until the three cards needed have been drawn. The performer then places the pack upon his table and comes forward with an envelope, into which he requests the three cards to be placed. The envelope, Fig. 11, should conform to the cards in size and shape. It consists, in reality, of two thin paper envelopes of the same dimensions and color, having their faces pasted tightly together with one of their flaps at the top and the other at the bottom of the combination as represented respectively by the solid and dotted lines in the illustration.

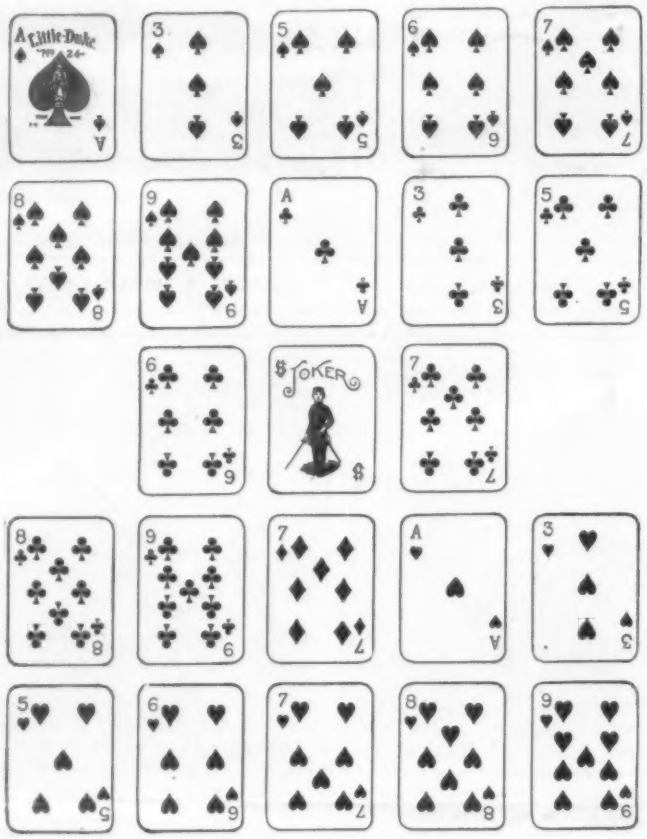


Fig. 9.—THESE CARDS IN A PACK BY REASON OF THEIR MARKING ARE FAVORITES WITH MAGICIANS.

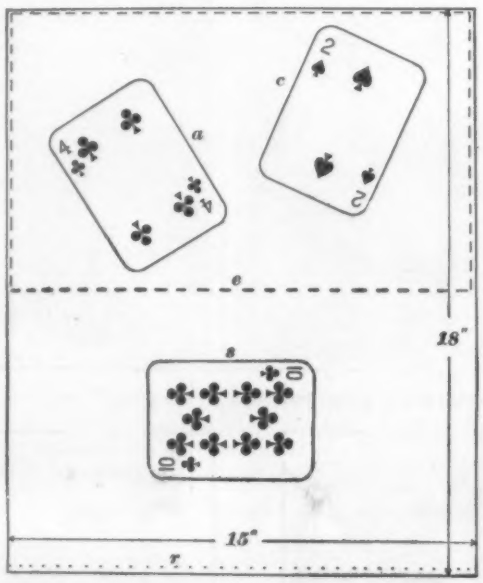


Fig. 10.—AN EASILY CONSTRUCTED CARD TARGET.

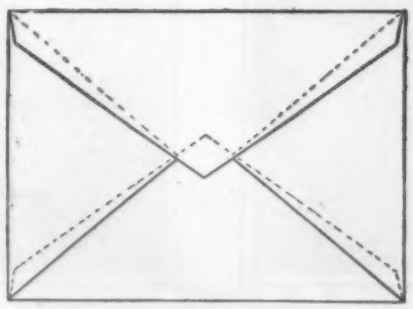


Fig. 11.—THE DELUSIVE DOUBLE ENVELOPE.

In one of the compartments some finely cut papers are placed beforehand, and into the other compartment, which is the only one now shown to the spectators, the performer requests the three chosen cards to be placed. The envelope, of course, is not allowed to leave the performer's hands while the cards are being inserted. As soon as the cards are deposited within, the performer places the envelope, card side down, upon a table, and throws a handkerchief over it. After a few passes of his wand above the handkerchief he brings the envelope to view and opens the flap covering the finely cut papers. He allows these to run out in a heap on the table and proceeds to load them into the muzzle of a pop-gun, previously borrowed from one of the younger members of the family.

Calling up his assistant from the audience, he hands him the target, the lower half of the outer cloth up as already explained, and bidding him hold it with both hands in front of his body, stations him in range at the opposite side of the room. He then aims the pop-gun at the target and shoots. Simultaneously with the report the assistant makes a half step backward and at the same time quickly lowers and raises the cloth about six inches as if startled by the noise. Under cover of these two movements, regarding which the assistant has been previously instructed, he drops the lower half of the outer cloth, revealing to the spectators the three chosen cards, apparently shot from the pop-gun.

(To be continued.)

The Death of Oscar Erbsloch.

Oscar Erbsloch, the noted German balloonist, who won the international balloon race of 1907, met his death near Opladen, Germany, with four companions. Only a few peasants were witnesses of Erbsloch's end and that of his four companions.

Erbsloch had ascended in a dirigible airship of his own construction. The craft disappeared in the fog, and shortly afterward a loud explosion was heard. The crumpled mass fell to the earth with the swiftness of a plummet. The car was smashed to splinters and the motor buried deep in the sod, while the five passengers were crushed and torn almost beyond recognition.

It is difficult indeed to determine the exact cause of the accident. An examination of the wreckage would seem to indicate that the fuel tanks may have exploded, perhaps because of a leak. A brief note was found containing a short record of the journey, which reads as follows:

"Departed hall 9:04; ascended air 9:09; thick fog northward. Cannot see earth, sun breaks through; heavy fog below us. Elevating planes sloped downward; altitude 280 meters (916 feet) at 9:14."

Erbsloch's dirigible was of the non-rigid type, 176 feet in length and 33 feet in diameter. The motors were of 125 horse-power, and calculated to drive the machine at a speed of 28½ miles an hour.

Erbsloch was one of the most practised balloonists in Germany. Besides winning the Gordon-Bennett race in 1907, held in this country, he won prizes at Brussels, October 15th, 1907, Essen, December 29th, 1908, Krefeld, December 15th, 1908, Duesseldorf, June 9th, 1907. He was the president and one of the founders of the Rheinisch-Westfaelische Motorluftschiffahrt Gesellschaft, as well as a member of many German aeronautic organizations.

The airship in which he was killed was called the "Erbsloch," and was built in 1909 by the Rheinisch-Westfaelische Motorluftschiffahrt Gesellschaft.

A NOVEL MOUNTAIN ELEVATOR

BY L. RAMAKERS

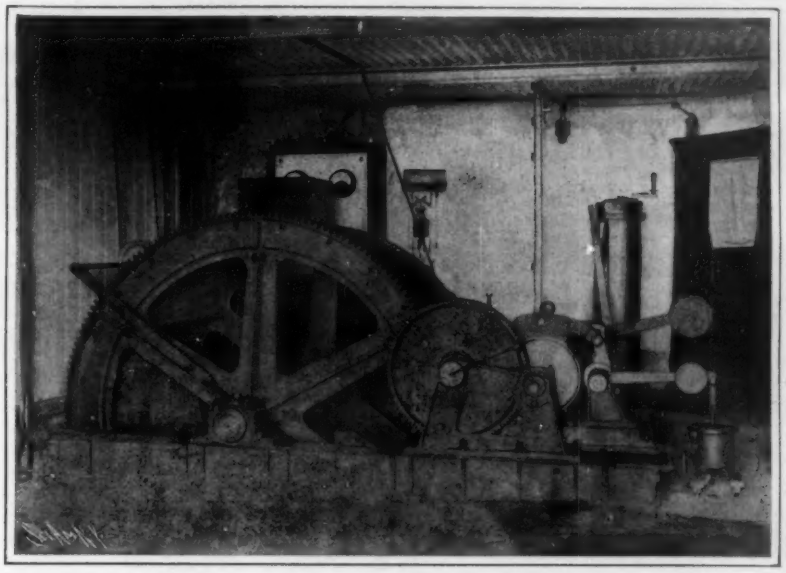
A very interesting mountain elevator was recently put into service in Switzerland.

The summit of the Bürgenstock terminates in a vertical cliff, the top of which is 1,120 meters (3,674 feet) above the sea level. The ascent of this peak, hitherto very difficult, has been made easy by the construction of the elevator, which rises from the terminus of the cable railway. The total height of the elevator is 161.65 meters (530 feet).

A tunnel 10.47 meters (34 feet) in length leads from the cable railway station to the foot of the elevator. The car rises first through a shaft 43.50 meters (143 feet) deep, bored in the mountain, then through a steel skeleton tower 118.15 meters (387 feet) high, erected over the shaft. The alighting platform is 150.85 meters (495 feet) above the bottom of the shaft and is connected with the summit of the mountain by a steel foot bridge 11.50 meters (38 feet) long. The pointed roof of the tower has a height of 4 meters (13 feet), exclusive of the lightning rod, which is more than 2 meters (6½ feet) long. The tower proper is 114.15 meters (374 feet) high and about 2 meters (6½ feet) square. At about the middle of its height it is anchored to the rock by a framework of girders 8.90 meters (29 feet) long and 3 meters (10 feet) wide except at the tower end, where its width is contracted to that of the tower.

The elevator has been designed to meet the peculiar conditions of the Swiss Alps. Although mountainous regions are alike all over the world, it is not likely that this installation would be generally applicable.

The elevator is designed to carry a load of 1,320 pounds. The car is built of mountain spruce and sheathed with zinc. The platform measures 1.55 meters by 1.8 meters (5 feet by 6 feet) and is furnished with two benches. The speed of ascent is 60 meters (197 feet) per minute. The time of ascent, including the start and stop, varies from 2 minutes and 50 seconds to 3 minutes, according to the voltage of the current which drives the motor. The central power station, which furnishes the current, also supplies the Bürgenstock and Hanserhorn cable railways. Consequently, the tension, normally 1,200 volts, sometimes falls to 900 volts. The elevator is operated by a shunt-wound, bipolar, direct current motor of a normal capacity of 1 horse-power. The motor makes 900 revolutions per minute, and in starting the elevator develops a maximum of 2 horse-power. The magnet core is of cast steel, with annular winding. The rotor has a total diameter of 380 millimeters (15 inches) and a thickness of iron of 200 millimeters (8 inches). The prolongation of the driving shaft bears a pinion of 16 teeth, which drives a wheel of 115 teeth. The fixed arbor of this wheel carries a loose pinion of 14 teeth which engages with a wheel of 181 teeth attached to the winding drum of the cable. This drum, made of oak, is 2 meters (6½ feet) in diameter and weighs 1,700 kilograms (3,750 pounds). From it two cables, 16 millimeters (⅝ inch) in diameter, run over guide wheels 1 meter (39 inches) in diameter at the top of the tower and terminate at the car. A third cable of equal thickness runs from the drum over a wheel 900 millimeters (35½ inches) in diameter to the counterpoise. The breaking strength of each of these cables, which are composed of steel wires 1 millimeter (1-25 inch) in diameter, is 16,000 kilograms (35,200 pounds), and as there are two supporting cables and the total weight of the cage and cables is about 1,600 kilograms (3,520 pounds) the factor of safety is 20.



The cable drum, motor, etc., at the bottom of the shaft.

All the machinery rests on a cast iron base, which is screwed to a U-shaped iron sub-base countersunk in a concrete foundation. It is installed in a chamber hewn in the rock at the bottom of the shaft. Here, too, are the starting, stopping and brake levers and the switchboard.

Safety devices are evidently very necessary with an elevator like this and they have been supplied in abundance. In the first place, there is a speed regulator for the case in which the car attains, from any cause, a velocity of 80 meters (262 feet) per minute. This regulator acts on a safety device attached to the car and thus causes friction blocks to be pressed against the sides of the latter. As the descent is checked the slackening of the cables sets into action an interrupter which cuts off the main current, on the cessation of which an automatic shoe brake comes into play and the machinery gradually comes to rest.

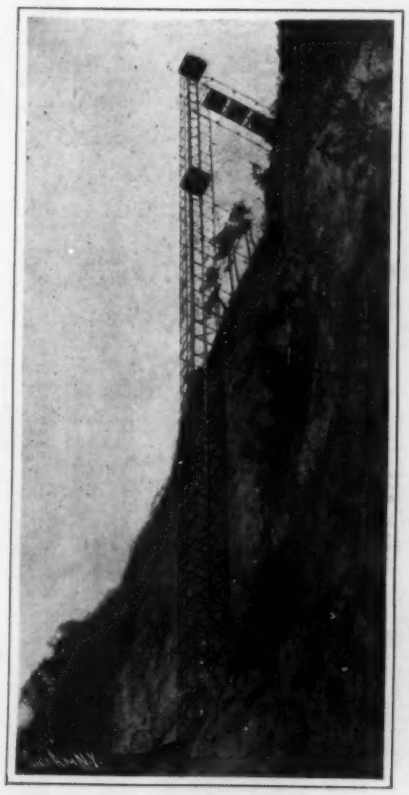
A second speed regulator cuts off the current and applies the brake as soon as the car attains a speed of 70 meters (230 feet) per minute. The second regulator is added for the purpose of avoiding too frequent use of the friction blocks.

In order to prevent the car's being carried up to the pulleys a device is added which brings back the controller to the zero position as soon as the car reaches a point from which its momentum will carry it to the end of its course. This contrivance is designed to supersede the operator in case of accident or inattention.

In the fourth place there is an interrupter for the ends of the course with a lightning arrester of the horn type. This interrupter is set into action by the car or by the counterpoise, according as the former is approaching the bottom or the top of its course. The current is thus cut off and the brake is then applied automatically.

The cable drum is provided with a band brake worked by a hand lever, which at the same time opens the interrupter just described. An indicator keeps the operator constantly informed of the position of the car and enables him to operate the controller accordingly. When the safety device on the car has acted and the car has been stopped by the friction blocks it may be raised by turning a crank, without using the current. If the current should cease to flow from the power station a relay would immediately apply the principal brake and stop the car.

Finally, if all of these safety devices fail the parachute can be released by moving a lever in the car. The conductor can, therefore, stop the car at any moment and, if necessary, he can descend to the engine room by a ladder affixed to the outside of the tower and work the elevator by hand, by means of the crank already mentioned.



The elevator tower seen from below.

Top of elevator tower.

A NOVEL MOUNTAIN ELEVATOR.

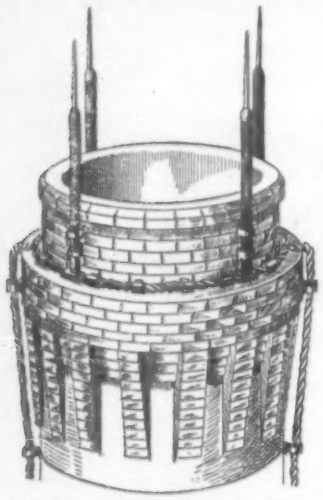
A meter for measuring the rate of flow of gas or air which can be adapted for use as a steam meter or as a steam calorimeter, taking the quality of all the steam passing through a pipe instead of that of a sample of steam, was recently described to a meeting of the American Society of Mechanical Engineers. The operation of the gas meter depends upon the principle of adding electrically a known quantity of heat to the gas and determining the rate of flow by the rise in temperature of the gas (about 5 deg. F.) between inlet and outlet. The meter consists of an electric heater formed of suitable resistance-material disposed across the gas passage so as to impart heat at a uniform rate to the gas. The resulting rise of temperature is measured and autographically recorded by means of two electrical-resistance thermometers, one on each side of the heater. These consist of resistance-wire wound upon metal tubes so placed that all the gas passing through the meter comes in close proximity to the thermometers. The adoption of this principle of operation permits the construction of a very accurate and sensitive autographic meter of large capacity containing no moving parts in the gas passage; it is independent of fluctuations in pressure and temperature of the gas, and capable of measuring gas or air at either high or low pressures or temperatures. The electrical energy required is about 1 kilowatt per 50,000 cubic foot hourly capacity, at the pressures ordinarily used in gas mains.

On June 30th there were 126,644 freight cars idle in the United States.

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

LIGHTNING CONDUCTOR POINT AND POINT-ROD PROTECTOR.—CARL BAJOHR, 4051-4057 Keokuk Street, St. Louis, Mo. Due to the nitric, sulphuric, and muriatic acid fumes present in various gases of combustion, lightning conductor points on power plant and smelter chimneys are frequently



PROTECTED LIGHTNING ROD POINTS FOR CHIMNEYS.

eaten away, or so badly corroded as to destroy their efficiency. To overcome this condition, the lightning conductor point here illustrated has been invented, which consists of a platinum-tipped point mounted on a rod which is protected by a tubular jacket of carbon.

HANGER FOR ELECTRIC LIGHTS.—E. H. WEBER, Chisholm, Minn. The hanger is intended as a substitute for the so-called "crow foot" hanger and various others now in use. It is distinguished chiefly by a spring-support and rocking bearing for the hanger proper. The device may be easily and quickly attached to and removed from the ceiling or other overhead support.

Of Interest to Farmers.

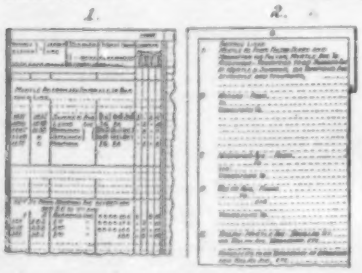
CLEVIS.—T. DEN BESTEN, Corsica, S. D. This invention is an improvement in safety clevises of a character to automatically release the draft animal or animals from a plow or other draft appliance, should the same strike an unyielding obstruction, and thereby prevent the breaking of the implement or the harness.

WELL-SCREEN.—W. HARMON, Tiffin, Ohio. In the practical use of this invention the slots which permit the passage of water, will operate to hold back the stone and coarse gravel which in turn will form a screen and hold back the smaller particles. These in turn also form a screen and hold back still smaller particles and so on. When the screen has been inserted in position in the well all small particles will be pumped off, after which the well will be ready for use.

Of General Interest.

CITY STREET DIRECTORY.—PAUL NOGUIER, 1004 Myrtle Avenue, Brooklyn, N. Y. An improved street directory has been invented, comprising a set of index pages containing page numbers, arbitrary characters, and transportation information indicated by said characters, while each of another set of pages bears the name of a street, a column giving

1. 2.



CITY STREET DIRECTORY.

the names of intersecting streets, numerical designations of the index pages associated with a character corresponding to the character heading the information on the corresponding index page. The section devoted to transportation lines provides valuable space for advertising.

Machines and Mechanical Devices.

MACHINE FOR TURNING IRREGULAR FORMS.—A. LEHMANN, New York, N. Y. The object of the present invention is to provide a machine for simultaneously shaping a number of irregular forms, such as tobacco pipes and like articles, according to a predetermined model, the machine being arranged to automatically stop feeding when work is finished to allow removal of finished articles and replacing of the same by new work, thus permitting the shaping of a large number in a comparatively short time.

AEROPLANE.—G. GERALDSON, Newcastle, Cal. This invention pertains to aeroplanes, and has for its object the provision of means by which the aeroplane may be directed upwardly or downwardly at the desired inclination, without altering the position of the center of gravity of the car relative to the supporting aeroplane.

FLYING-MACHINE.—T. M. CREPAR, Fargo, N. D. An object here is to provide a machine with variable vanes which together with planes form an aeroplane body, there being an opening in the center of said body in which are disposed propellers and there is disposed another plane over the said main or principal plane, the upper plane also having a central opening therein.

FEEDING DEVICE FOR TENTERING-MACHINES.—B. PARKINSON, East Greenwich, R. I. The object of the inventor is to provide a feeding device which will produce a saving in labor and which can be operated by a single operator working continuously. In this way he replaces three operators by a single operator, and reduces the cost of feeding the machines to about one-third of the cost under former conditions.

Pertaining to Vehicles.

CART.—M. C. MYERS, Reno, Nev. The object of the inventor is to provide a device which may be placed close to the ground for loading, thus dispensing with the necessity of elevating the material, and which after loading will be elevated out of contact with the ground by the act of closing the lid, and which may be inverted for removal and to bring the cart into position for unloading.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Legal Notices

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AEROPLANE FATALITIES.

(*Continued from page 69.*)

to have been distinctly due to a failure in the main structure of the machine used. Since Delagrange was killed in a monoplane and Rolls in a biplane, it is of course impossible to draw any conclusions as to the safety of either type, although it is popularly supposed that the biplane is a steadier, and, therefore, a safer machine.

In all such accidents, it is difficult indeed to establish the cause of the mishap after the event. The machine is usually so damaged that it is impossible to tell what happened from the broken parts. In the case of Capt. Ferber and Fernandez, there is no evidence that any part of the machine failed, and in the case of Lieut. Selfridge and Lefebvre, the main framing certainly did not fail.

In commenting on these accidents, Engineering of London pointed out some time ago that theoretically at least, accidents due to inherent defects in the machine would seem to be more likely to happen to a monoplane than to a biplane. The top and bottom members of a biplane are both of wood, with wood struts, the whole being braced with very numerous ties of wire. In the monoplane, however, the main spars of the wing are trussed to a strut below by a comparatively small number of wires. The structure of each wing is, in fact, very much like that of the mast and rigging of a sailing boat, the main spars taking the place of the mast, while the wire stays take that of the shrouds. The sailing boat, however, is almost invariably provided with a forestay to take the longitudinal pressure when going head to the wind. The wing of an aeroplane is usually unprovided with such a forestay, the longitudinal pressure due to the air resistance being taken entirely by the spar. Perhaps this may have something to do with the fatalities which the monoplane has to its score. The more powerful the motor of a monoplane, the less is the factor of safety. In Delagrange's case, for example, a new motor was fitted to the Blériot monoplane in which he was flying, a motor so very light that its extra weight was negligible. The more powerful engine drove the planes a great deal faster through the air than before. Hence the stresses brought upon them by the air resistance were considerably increased, and since no provision was made to meet this, it may be that Delagrange came to his end because of that neglect.

The question of the most suitable material and fastenings for the support of wires in monoplanes and biplanes is a matter which manifestly requires much consideration. So numerous are the wires of the biplane, that the failure of one or even more may not endanger, except where it may possibly dangle in the way of a swiftly revolving propeller, and thus bring the machine to grief. Other things being equal, however, even if one wire should break, the biplane stands a better chance of reaching the ground in safety than the monoplane. The failure of even one wire may mean a broken wing in the case of the single-surface machine.

Perhaps the wire stays used may have something to do with these accidents. On the monoplane the stays are usually of solid steel wire or ribbon. The shrouds of a saling boat are usually of stranded rope, for solid wire has not been found satisfactory. Solid wire will carry a heavier strain than the stranded rope, weight for weight, but is not so trustworthy. Stranded rope rarely breaks without warning, the breakage of several strands being usually seen before the entire rope parts. When a single wire breaks, there is no previous warning.

Many of these accidents point out the folly of striving for records. Safety and trustworthiness are far more to be desired than great heights, great speeds, and long runs. In the record-breaking machine, trustworthiness and safety are

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Valve and valve actuating arrangement of internal combustion engines, S. I. Parker	964,308
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Valve for train pipes, E. E. Allbee	964,081
Valve mechanism for Corliss engines, B. T. Allen	964,194
Valve operating mechanism for flush tanks, etc., W. J. Frost	964,098
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Vats and similar receptacles, device for cooling store, J. ten Doornkaat-Koolman	963,751
Vehicle body, J. A. Bieber	963,854
Vehicle brake, C. W. Olson	963,930
Vehicle lift, J. R. Lockerd	964,113
Vehicle light, W. S. Bond	963,379
Vehicle spring, D. R. Close	963,870
Vehicle wheel, S. E. Chapman	963,990
Vehicle wheel, Benham & Slater	964,462
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Vending apparatus, J. T. Davis	963,748
Vending machine, cigar, H. J. Davidson	963,999
Ventilator. See Car ventilator.	
Ventilator, J. G. Clark	964,146
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Web feeding mechanism, C. B. Stilwell	964,130
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Wire cable, repairing, McIntosh & Bain	963,800
Wire cramps and driving them into pasteboard and other material, mechanism for forming, Bonnesen & Engblom	964,202
Wood, transforming, W. A. Hall	964,017
Wrench, A. S. Steen	964,067
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Wrench, J. G. Porttens	964,313
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Wrench, G. H. Watson	964,346
Wrench attachment, monkey, F. Fisher	964,010
Yoke, neck, D. F. Tanner	964,134

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since October 4th, 1859, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., Inc., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., Inc., 361 Broadway, New York.

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(*Concluded from page 74.*)

sacrificed to a certain extent, because of the necessity of carrying the highest-powered motor possible and the greatest amount of fuel possible. This necessarily means a reduction in weight, and therefore a reduction in the margin of safety.

A DINOSAUR SKELETON.

(*Concluded from page 65.*)

knowledge of the group. It lies on its back as found, with arms outstretched and neck twisted to the right side, with the skull under the right arm. The tail is missing, but otherwise it is complete from the tip of the nose back to the hips, with the body almost completely incased in its skin. To be more exact, it is a cast of the skin, for when examined critically, there proves to be no organic substance, simply an imprint of the tubercles formed in fine-grained sand. The tubercles or scales are non-imbricating, that is, do not overlap, like those of a snake, and are roughly pentagonal in form with flat tops. These grade into small irregular tubercles in different parts of the body, forming patterns. It is probable that genera of the same family were in life readily distinguishable by the different skin markings, as among modern lizards.

On its belly, chest, and sides there are rosettes or clusters of large tubercles separated by small pointed tubercles.

Near the mid-ventral line they are from one to one and a half inches in diameter, slightly elongate, and consist of large scales near the center, which gradually decrease in size to the periphery, where they are small irregular pointed tubercles. These small tubercles allowed of creasing or folding of the skin during life. The rosettes are distributed in more or less regular alignment, apparently in rows, with frequent intercalated rosettes. Distinct folds in the skin are still preserved, running down the sides of the body at right angles to the vertebral column. Probably the most important part of the epidermis preserved is that covering the front legs. It is unbroken on the front and the back and shows one foot to have been webbed more completely than in any water bird.

The thumb is absent, so that the four toes present are II., III., IV., and V. II. and III terminated in small hoofs; the other toes in small round ossicles, but all were completely covered by membrane. No pads are present, and the delicate texture of the scales is strong evidence that the foot was used chiefly as a paddle, and not for walking.

Part of an ornamental dorsal frill is preserved, overlying the neck, and consists of uniformly large tubercles that outline, and at least in some places extend above the spines of the eighth, ninth, tenth and eleventh cervical vertebræ.

The large tubercles were separated by small ones between the spines. Doubtless this resembled in prominence the frill of the living iguana.

In another specimen, representing a different genus, the scales that cover the tail are uniformly large with flat tops and fluted sides, but not differentiated into patterns. In general, the epidermis appears to resemble that of the geckos more nearly than any living lizard.

In *résumé*, it would appear that the ventral side of the body or belly was covered by small rosettes or clusters in more or less regular lines, which increased in size over the sides and were uniformly large on the back and tail and on the outer side of the limbs. Small tubercles not differentiated into clusters marked the inner sides of the limbs and in the folds of the skin, where there was friction. A short erect dorsal frill ornamented the neck, and possibly a part of the back. That the skin was pigmented seems probable, but nature would not have made a defenseless bulky creature of this size more conspicuous by brilliant colors.

PENNSYLVANIA RAILROAD

Bulletin

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